SIGNS of DROWNING

With the Author's Comp

THE

SIGNS OF DROWNING

MEDICO-LEGALLY CONSIDERED.

BY

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"There is no magnifying-glass like a prejudicate opinion."—*Bacon.*

"Let us have God's truth in the measurements; God's truth in everything—I live for that."—*Goodsir.*

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TO

MY FATHER,

I,

MOST AFFECTIONATELY AND MOST GRATEFULLY,

Dedicate

THIS ESSAY.

PREFACE.

After having heard some remarkable evidence on the Signs of Drowning at Stirling in 1865, in a charge of murder by drowning, before the Circuit Court of Justiciary, it occurred to me that an investigation of these signs would form a very good subject for an inaugural dissertation. I stated my opinion to my father, who has been long engaged in medico-legal practice, and he not only agreed with me, but at the same time offered to furnish me with *matériel*, sufficient, as he thought, to illustrate the subject pretty fully. He afterwards put me in possession of a large collection of medico-legal cases, made by him during a long series of years, from which I have selected whatever I considered suitable for the illustration of my subject.

I have also been greatly indebted to several gentlemen resident in this district for a large number of the fifty cases of drowning which form the Table.

I have myself, too, had an opportunity, during the last few years, of examining several cases of drowning, and also several other cases in which the question of drowning was raised.

Hence, derived from these sources, the original and practical character of this Essay.

The Terrace, Stirling, 1870.

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CHAPTER I.

THE SIGNS OF DROWNING.

Signs of drowning—Apnœa—Water in lungs—Frothy mucus in lungs—Hyperæria or balloon lung—Water in stomach—Goose-skin, &c.—Relative frequency of signs—Table of fifty cases of drowning—General conclusions.

APNŒA, or the arrest of the Respiratory Function, is produced in at least three different ways, namely, by strangulation or suffocation, by immersion of the body in water or any other fluid, and by the inhalation of any of the gases unfitted to support respiration. The appearances presented in the body after death by apnœa, however this may have been caused, are very much the same. Hence, in medico-legal practice, it often becomes a question of great nicety, especially in suspected cases of drowning, to determine by a *post mortem* examination of the body, how the apnœa has been induced. This can only be done by observing carefully certain signs peculiar to each of the three forms of apnœa; and thus in all such cases we have to consider, along with the general signs of apnœa, the special signs either of strangulation or suffocation, of drowning, or of the inhalation of a gas unfitted to support respiration.* In this Essay, therefore, I have to consider the signs of drowning in connection with the signs of apnœa, always and necessarily more or less present in cases of drowning. Now, the signs of drowning are—1, The presence of water in the larynx, trachea, and bronchi or lungs; 2, The presence of frothy mucus in the larynx, trachea, and bronchi or lungs; 3, Hyperæria of the lungs, or Balloon Lung of

* See Appendix A.

Casper; 4, The presence of water in the stomach; 5, Goose-skin, retraction of the penis, &c. I shall consider these different signs *seriatim.*

1. *Water in the lungs.* A very great discordance of opinion exists among authors on this sign. De Haen thought that the lungs were so much filled with water as to stop the circulation of the blood through them. Morgagni, on the other hand, could not find water in the lungs of guinea pigs drowned by him.[1] Cullen, in his letter to Lord Cathcart, states, as the result of many dissections, that there is often no water in the lungs, and that the quantity is never so great as to injure their organization in any way. Goodwin, after many interesting experiments, concludes that although a small quantity of water usually enters the lungs, the quantity is never so large as to produce death. Professor Meyer, of Bonn, in his experiments, performed under all possible circumstances, uniformly found it not only in the windpipe and its great ramifications, but also in the minute bronchial tubes: he adds, however, that it was only sometimes found in substance, and more commonly in the form of froth. Orfila and Devergie both state, that in many instances they have seen more or less water in the lungs. Taylor says that water is only occasionally met with in them, and that the quantity is commonly small and subject to variation. Casper, believing the frothy fluid found in the lungs to be a product of inhaled water, says nothing about water itself being found in them. From these, and a host of other authors I deem it unnecessary to quote, it is abundantly evident, that water in substance is only occasionally found in the lungs of drowned persons. The sign, therefore, cannot be of much value. This value, too, whatever it may be, is materially lessened by the fact, established by Orfila and

[1] "Nihil hujus in ventriculo, nihil in gula, *nihil in trunco arteriæ asperæ* habuerunt; spumosus dumtaxat humor, manu e pulmonibus exprimebatur." —Morgagni *de sedibus et causis morborum*, 1766. Vol. ii. p. 108.

others, that water can and does enter the lungs after death. Taylor and Casper, however, say that the sign becomes completely infallible by the presence of foreign matter in the water, such as liquid manure, soapy water, weeds, &c. It is difficult to see this, for if water can enter the lungs after death, the greater number of the substances just enumerated may enter them along with it. The experiments of Orfila, indeed, show this. He found that coloured fluids entered the extreme bronchial ramifications after death. On the whole, then, this sign cannot, under any circumstances, be considered as of much value.*

2. *Frothy mucus in the lungs.* This sign is much insisted on by most authors, and, as will be seen in the following Table of cases of drowning, by witnesses generally in our criminal courts, as of great value. I am, notwithstanding, satisfied that it does not possess the great value so often claimed for it. Like water, frothy mucus may or may not be present in the air-passages. In cases 1, 2, 4, 8, 10, 12, 18, 19, 20, 22, 23, 25, 28, 31, 32, 33, 35, 38, 39, 41, 42, 44, 48, of the following Table, all of them known to be cases of drowning, no frothy mucus was found although carefully looked for. Its absence, therefore, in any case, cannot be of much importance when other indubitable signs of drowning are present. Much confusion appears to me to exist everywhere in regard to this sign; and even its nature, origin, and mode of formation are still matters of dispute. Casper, who attaches a great value to the sign, says that it consists of small pearl-like bubbles, sometimes completely filling the whole tracheal canal. He describes it as a mixture of the inhaled fluid (water) with the normal air and mucus contained in the lungs and trachea, the mixture being formed by the final forcible respiratory movements. He further states that this mixing of these fluids may occur under any circum-

* See Appendix B.

stances, that it is altogether independent of any extraordinary inhalation of atmospheric air, and that it occurs in persons who, after immersion, never come again to the surface alive. Taylor, on the other hand, ascribes the frothy mucus to the simple agitation or admixture of the air respired during the act of drowning with the mucus secretion of the air-passages, and evidently considers the inhalation of water unnecessary to its production. It has not been found, he says, in the bodies of those who have sunk at once below the surface. Beck, quoting Devergie, attaches great importance to the sign. He describes the bubbles as having a watery envelope and being easily broken. He says nothing whatever as to its origin or mode of formation. Amidst such conflicting statements as these, it is difficult to arrive at a satisfactory conclusion in regard to the value of frothy mucus in the air-passages as a sign of drowning. There can be no doubt, however, that it is frequently found in them, whether existing as the pearl-like bubbles of Casper or as the watery bubbles of Devergie.[1] There can be no doubt, also, that it is often altogether awanting in many persons known to have been drowned, and that its presence, as most practitioners seem to believe, is not necessary to establish the fact of drowning. As to its character and mode of formation, the opinion of Taylor is, in all probability, correct, namely, that inhaled water is unnecessary to its formation, and that it consists simply of the admixture of the air forcibly respired during drowning with the mucous secretion of the air-passages, and with, I may add, any other fluid, such as

[1] The more the bubbles approach the character of the bubbles of Devergie, the better the evidence of drowning. Casper's pearl-like bubbles occur in all the different forms of apnœa, but Devergie's watery bubbles occur only in the apnœa of drowning; and they prove incontestibly the occasional inhalation of water into the lungs during drowning. My experiments, Appendix E, go to show that such an inhalation of water takes place in every case of drowning among some of the lower animals.

water or blood, that may happen to be present in them. From all this it must appear that the sign cannot possess the great value so very generally ascribed to it. I shall allude to it a little further under the next sign.

3. *Hyperæria of the lungs, or Balloon Lung of Casper.* We are chiefly indebted to Casper for this important sign. Other authors may have alluded to it, in a general way, as an increased volume of the lungs; but to Casper, and to him alone, assuredly belongs the great merit of giving to the hyperæria its deservedly high value as a sign of drowning. To Casper we are also indebted for the only good description of the sign. "It," he says, "consists in a complete distension of the chest by the lungs, which press close to the ribs, and almost completely cover the heart. They appear to be inflated like a balloon, and are not like ordinary healthy lungs, tolerably firm and crepitating, but feel exactly like a sponge."[1] Now, I have nothing to add to this excellent description of the balloon lung further than that when fully developed cases occur, the lungs, when liberated from their confinement, rise far above the cut ends of the ribs, and that they feel more like a wet inflated bladder, so secured that it cannot be emptied by pressure, than a sponge that can always be easily compressed. Such were cases 5, 22, 25, 26, 28, 31, 40, 43, 50, in the following Table. The following case by Casper is also a good example of extreme hyperæria: "The lungs were hypervoluminous, and contained no water, and but little blood. The trachea was pale, quite empty, and remained so even after pressure was made on the lungs. The right side of the heart and the pulmonary artery contained a quantity of perfectly fluid blood."[2] But when the lungs adhere to the ribs by old and firm adhesions, they do not rise in the manner described. They always, however, feel like a sponge or wet inflated bladder, and give no evidence of crepitation. The

[1] Handbook, vol. ii. p. 239.

[2] Handbook, vol. ii. p. 235.

question now arises, What gives origin to this enormous and fixed inflation of the lungs? Here again a great difference of opinion would, on inquiry, be found to exist, involving, in fact, the whole question of the presence and origin of frothy mucus. To this, however, I deem it unnecessary to recur. I shall simply state Casper's opinion of the nature of the balloon lung, and offer some remarks of my own on his opinion. "This distension of the lungs," says Casper, "is in part an actual hyperæria, in consequence of the most violent inspiratory acts carried on at the momentary emergencies of the head of the drowning person above the surface of the water, but partly and chiefly a consequence of the inhalation of the fluid in which drowning has occurred into the lungs, as has been indubitably proved by experimenting on animals with coloured fluids, and by my own experience in regard to specific fluids."[1] Now, this opinion, vague and uncertain in itself and somewhat contradictory, is scarcely in accordance with the opinion formerly given regarding the origin of frothy mucus in the balloon lung. At page 238 (Handbook) he says, "Devergie states that the froth can only be found in the trachea when the person, in drowning, has been able to get his head above water, and thus inhales atmospheric air; but numerous observations, all clear and decided, enable me to declare positively that this opinion is erroneous. Even in the case of men who were well known to have gone at once under ships or logs of wood the instant they fell into the water, and who never came up to the surface alive; in that of others who had loaded themselves with heavy stones for the purpose of sinking themselves at once, and who seem necessarily to have attained their object, I have found this appearance in the trachea, precisely the same as in those other cases in which a repeated emergence above the surface of the water, although not positively known, might yet have

[1] Handbook, vol. ii. p. 239.

been supposed to have taken place."[1] If this opinion is correct, the balloon lung cannot be a hyperæria; for it is formed under water where no air, and certainly no supply of air sufficient to produce it, could be inhaled. How, then, is it produced? Can anything else than air produce it? I hesitate not to answer this question in the negative. Air, and air only, can produce it; and cases of balloon lung frequently occur where no frothy mucus, although carefully and anxiously looked for, could be found. Such are cases 22, 25, 26, 28, 31, 38, in the following Table. In case 38, for example, a beautiful and extremely developed specimen of hyperæria, approaching in its nature or pathological condition to the character of emphysema, none was found, even while dividing the lungs into thirty pieces, and subjecting them to forcible compression. The case quoted from Casper, p. 13, is also a case of extreme hyperæria, without frothy mucus in the air-passages. Beyond all doubt, then, the balloon lung is a true hyperæria. It is the result, probably, of a sudden, violent, and instinctive act of inspiration made under dread of drowning, and before complete submergence of the head; and in cases of extreme hyperæria, I believe, this great and morbid inflation is generally effected by *one* act of inspiration of extreme violence.[2]

[1] Handbook, vol. ii. p. 235.

[2] "So is reflex inspiration purposive and beneficial; it produces our first inspiration, and if the stimulus of the air is insufficient for this, we have but to use cold water to secure gasping and forcible inspiration; it inflates the lungs, and renders us buoyant whenever we unexpectedly fall into the water.'—Roberts "On the Mechanism of the Thorax."—*Edinburgh Medical Journal*, 1867, p. 240. Swimmers should beware of "headers," especially the first of the season. These, I believe, sometimes give rise to hyperæria, even in the most expert swimmers, *e.g.*, "GRANTON.—DEATH OF A YOUNG MAN WHILE BATHING.—A young man, named Robert Robertson, met his death yesterday afternoon, while bathing at the east end of Granton harbour. Two other young men, who were also bathing at the same time, saw him struggling immediately after diving. They at once, but with great difficulty, got him on shore, where restoratives were applied by the inhabitants, and every effort

This act accomplished, the lungs and their adjuvant muscles lose all their expiratory power, and indeed all power; and the air thus inhaled remains fixed in the chest, where it soon loses its power of supporting respiration. In other words, the respiratory system is in a state of *neuroparalysis* from over distension of the air-passages. Of this we have an apt illustration in an over-distended urinary bladder, requiring the use of the catheter to empty it. The lungs and urinary bladder, with their adjuvant muscles, are, indeed, both in the same helpless condition. Now, however paradoxical it may appear, drowning by hyperæria is caused, not by a deficiency but by a superabundance of atmospheric air, soon however becoming unfitted for respiration, in the air-passages.[1]

By adopting these views of Hyperæria, many things hitherto considered anomalous in the history of drowning are satisfactorily explained; such as the drowning of persons floating on the surface of deep water, and who have never been submerged; the drowning of persons in shallow water; the floating of some bodies, and the sinking of others, immediately after drowning; the discordance of opinion regarding the frothy mucus in the lungs; and also, I believe, many of the cases vaguely, and often no doubt erroneously, ascribed to apoplexy and general *neuroparalysis*.*

for restoring respiration was tried, but without success. The doctor of Her Majesty's despatch-boat *Jackal*, who was present, is of opinion that death resulted from concussion of the brain and convulsions."—*Scotsman*, *August* 11*th*, 1870. No doubt a case of hyperæria occurring in an expert swimmer.

[1] There is some reason to believe, that this is not the only way in which hyperæria may be induced. Many cases of sudden death depending on emotional causes, such as sudden joy, fright, or shock of any kind, doubtless depend on preternatural inflation of the lungs. Death, too, occurring suddenly during the progress of tetanus and other spasmodic diseases, when persons are said to have died of asphyxia, no doubt depends on hyperæria. This would form a very curious subject for investigation.

* See Appendix D.

After the *neuroparalysis* is induced in the respiratory system, by one great and generally fatal act of inspiration, the depth of water under a person can be of little consequence, for death must necessarily follow at all depths; and, indeed, even although the head fell on the bank of a river, and out of the water altogether, the same result would inevitably follow.[1]

All such cases as these occur only in extreme hyperæria, the apnœa, as I have attempted to explain, being induced altogether by the neuroparalysis of the respiratory system, depending on a morbid distension of the air-passages.*

But the balloon lung, it is well known, sometimes exists, at least to a certain extent, along with frothy mucus, and sometimes also with frothy mucus tinged more or less with blood. This I do not at all deny. My only contention is, that the balloon lung, in its highest development, exists always and necessarily without frothy mucus or frothy blood in the air-passages. When either exists along with the balloon lung, its presence is a mere concomitant of the hyperæria, depending on other conditions of the lungs than the sudden and forcible introduction of air into them, such as a general congestion of the lungs, or a feeble development of the hyperæria. If the lungs are generally and much congested, blood may ooze through their mucus membrane and contribute to form a bloody froth in the air-passages, but in such a case the balloon lung is either altogether awanting or very feebly developed. Again, when the balloon lung is fully developed, frothy mucus

[1] The *Scotsman* of 4th May, 1870, has the following:—"CROFTHEAD.—MAN FOUND DEAD.—On Tuesday morning, a man, about twenty-four years of age, named William Cappin, a labourer, belonging to Strathavon, was found dead in a small stream near Crofthead, *into which he had tumbled early in the morning*. He was found with his head and body out of the water, and he is supposed to have died from exposure to the weather, which was very severe, ice having been found about a quarter of an inch thick at several places at Crofthead that morning." His death, more probably, was caused by hyperæria.

* See Appendix C.

cannot possibly exist in the air-passages under the enormous pressure of the air confined in them.[1] Under such a pressure, froth would necessarily disappear like the bubbles of water in a steam boiler under the pressure of the confined steam. In like manner, this pressure of the confined air in a balloon lung must necessarily prevent any general or capillary congestion of the lungs, and hence it is found, that in all cases of extreme hyperæria the dark fluid blood never extends beyond the trunk of the pulmonary artery.

This important sign has been very much overlooked in this country, and it is seldom mentioned in our medico-legal reports on drowning. In the following Table it is only mentioned ten times, and by three reporters merely. All the other reporters are silent on the subject. Notwithstanding this neglect, it is, beyond all doubt, the most valuable of all the thoracic signs of drowning. (*Vide* Casper.)

4. *Water in the stomach.* This is a sign of great importance, and when present is generally held to be decisive of the fact of drowning. Casper attaches a great value to it, and says that it is found in almost every case, in quantities varying from complete distension down to a few spoonfuls. Taylor says that water may or may not be found in the stomach, and when found, that the quantity varies very much. He repeatedly failed to find it in the stomachs of cats. Dr. Ogston, of Aberdeen, found it in five cases out of seven. Devergie says that the quantity found generally varies from a pint to a quart, and that it is a phenomenon indicating the presence of life when it occurred, deglutition being necessary to produce

[1] The epithet "enormous" used here is unquestionably correct. When a fully developed balloon lung is completely exposed, so that both hands can be freely passed nearly all round it, no amount of pressure will reduce it. It is as unyielding as any case of hernia on which the taxis has been fully and unsuccessfully tried. The air confined in a balloon lung capable of resisting such "enormous" external pressure, must necessarily press "enormously" in the air-passages and on the tissues of the lungs.

it. The same objections often and justly brought against the sign of water in the lungs do not apply here, for all authors are agreed, that water never, under any circumstances, enters the stomach after death. "Riedel found no trace of fluid in the stomachs of five dead cats flung into the water, nor in those of three children placed under the water in a favourable position, and left there from one to two days. Kanzler did not find any in the bodies of those animals which he flung into water coloured with ink, even when their mouths were slit back as far as the articulations of the jaws, a cork placed between the two jaws, and the animal so placed in the water that its head and the mouth, so held open, should be uppermost."[1] * The only difficulty, then, that can arise during the investigation of this sign, is the possibility of the water having been drunk a short time before death. Casper gives a remarkable example of this:—"A boy, aged two years, playing beside his nurse on the banks of a mill-stream, fell into the water, and was immediately taken out dead. The stomach was almost completely full of water. The child had been thirsty, and had greedily drunk up a glass of water brought from a neighbouring spring by the nurse; shortly thereafter the nurse went away for an instant, and on her return found the child had fallen into the water and been drowned."[2] Now, the fact of a person having drunk water a short time before death, although it may lessen, does not altogether destroy, the value of the sign. Although in this instance the child may have drunk water immediately before its death, it does not follow that no water was taken into the stomach during the act of drowning. On the other hand, from the fact of the stomach being almost entirely full of water, the presumption is that it did take in more water from the mill-stream; and this surely might have been determined by a

[1] Handbook, vol. ii. p. 245. * See Appendix F.

[2] Handbook, vol. ii. p. 245.

comparative examination of the water in the child's stomach with the water of the neighbouring spring from which the child drank, and also with the water of the mill-stream in which it was drowned. A water, whether river or spring, reputed pure, and as such voluntarily drunk by all persons, always possesses characters of its own that may in general be easily detected by a competent observer. Each water has its own soluble salts, and its own detritus held in suspension, which a few reagents and the microscope would readily reveal, even to persons of ordinary observation and experience.[1]

A simple experiment of this kind would, for example, have determined beyond all cavil the accuracy or otherwise of the verdict of the jury in the famous Ireland's Eye murder. The legs of the prisoner's trousers, as was admitted by both sides, were saturated with water. The prosecution held that they were saturated while the prisoner was in the sea drowning his wife. The defence held that they were saturated by passing through ferns, highly charged with rain-water, while the prisoner was in the prosecution of his business as a landscape painter. It never, so far as it appears, occurred to the prosecution to have the trousers examined for the purpose of ascertaining whether they were saturated

[1] Agassiz, on his way to Brazil in 1865, addressed his Staff in the following terms:—"We should examine the loose materials in every river we ascend, and see what relation they bear to the dry land above. The color of the water, in connection with the nature of the banks, will tell us something. The waters of the Rio Branca, for instance, are said to be milky-white; those of the Rio Negro, black. In the latter case, the color is probably owing to the decomposition of vegetation. I would advise each one of our parties to pass a large amount of water, from any river or stream along which they travel, through a filter, and to examine the deposit microscopically. They will thus ascertain the character of the detritus, whether from sand, or lime, or mere river mud formed by the decomposition of organic matter. Even the smaller streams and rivulets will have their peculiar character."—*A Journey in Brazil*, by Professor and Mrs. Louis Agassiz. Boston, 1868. P. 16. The application of these instructions to the medical jurisprudence of drowning is quite evident.

with fresh or salt water. Yet, on this simple fact the whole case rested either one way or the other.[1]

The question, then, in reference to water in the stomach as a sign of drowning, seems to be not so much whether water was drunk immediately before death, but whether all the water found in the stomach was so drunk, or whether a portion of it, or all of it, taken into the stomach during the act of drowning, consisted of the water in which the body was found.

But when the water in the stomach contains impurities, which I need not state here in detail, so disgusting that no person would or could voluntarily drink it, the evidence, according to the opinion of all medical jurists, is conclusive. This then is, beyond all doubt, the most valuable of all the signs of drowning.*

5. *Goose-skin, retraction of the penis, &c.* These signs, along with paleness and coldness of the skin, all of which depend on mere exposure to cold, do not appear to me to merit much attention as signs of drowning. The "cholera hand," a cadaveric phenomenon, is of no value whatever. Sand, gravel, mud, &c., under the finger-nails, are of little value. The presence of the above signs may be stated in corroboration of any of the other and more important signs, but the absence of any one, or all of them, cannot in any way affect the diagnosis of death by drowning.

Having considered in a way sufficiently full for the purposes of this Essay the different signs of drowning, I shall now endeavour to ascertain the relative frequency of the signs, as this has been observed in ordinary medico-legal practice.

[1] This, in all probability, was a case of hyperæria occurring in shallow water: also the case of Mr. Purkiss, drowned in shallow water at Cambridge in September, 1865; and many other cases that could be cited.

* See Appendix E.

For this purpose I have tabulated fifty cases of drowning, reported according to the form observed in Scotland, on soul and conscience, for the guidance of the Crown. Here we ought to have the deliberate and matured opinions of the reporters, founded on a careful deduction from the observed facts in each case; and as such, many of the cases may, I know, be fully confided in. It must, however, appear, from the meagre and often unsatisfactory statements of the facts, that the investigation of the signs has sometimes been conducted in a perfunctory manner. In the Table seven cases occur, three of them free from putrefaction, in which no notice whatever is taken of the apnœal signs; and in one case submitted to me, which I declined to insert in the Table, no fact whatever, pathological or otherwise, was stated on which the opinion of drowning rested. This, surely, is highly reprehensible in any one employed in the discharge of so responsible a duty. We must, therefore, take the Table merely at what it is worth. The general neglect of hyperæria as a sign also affects very seriously the value of the Table.

In the Table, I have preserved the distinction betwixt the Signs of Apnœa and the Signs of Drowning, and given a column to each.

TABLE

OF

FIFTY CASES OF DROWNING.

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
1. Man found. 12th Nov., 1858.		No water in trachea or stomach.	Decomposed.
2. Man found. 7th July, 1859.		Putrid fluid issued from mouth and nose in large quantity.	Much decomposed. No marks of external violence.
3. A. M. 25th Aug., 1859.	Face swollen and livid. Blood-vessels of head congested. Heart empty. Large blood-vessels full.	Frothy mucus issued from mouth, and existed in trachea and its branches.	Good. Fifteen minutes in the water. No marks of external violence.
4. Man found. 2nd Sept., 1859.		Blades of grass in jaws and windpipe.	Putrefaction considerable.
5. J. C. 9th Dec., 1859.	Right ventricle of heart filled with dark fluid blood. Brain congested.	Hands clenched. Penis contracted. Frothy mucus in nostrils and trachea. Lungs distended, not collapsing.	No marks of injury.
6. Man. 13th Dec., 1859.	Right ventricle of heart and large vessels distended with dark fluid blood. Brain congested.	Frothy mucus around nostrils and in trachea. Small quantity of mud in nostrils and between lips and teeth.	No marks of injury.
7. A. M. 24th Jan., 1860.	Heart and large vessels filled with dark fluid blood.	Frothy mucus around nostrils and in trachea and air-passages. Stomach full of pure water.	No marks of violence.

TABLE OF FIFTY CASES OF DROWNING—*(Continued).*

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
8. J. W. R.	Lungs and brain congested. Right side of heart gorged with dark fluid blood.	No frothy mucus or water.	Free from putrefaction.
9. M. D. 5th March, 1860.	Right side of heart and large vessels gorged with dark fluid blood.	Mouth, nose, trachea, &e., filled with colourless frothy mucus.	No marks of injury.
10. J. M. 22nd June, 1860.	Dark fluid blood in right ventricle of heart.	Clear fluid issued from mouth and nostrils. No water in stomach.	Plump and healthy.
11. M. M. 2nd Feb., 1861.	Dark fluid blood in heart.	Trachea and stomach contained a clear fluid mixed with mucus.	Various slight abrasions caused by ice floating in water.
12. A. W. 27th March, 1861.	Lungs congested. Right heart distended with dark fluid blood.	Two pounds of water and mucus in stomach.	Free from putrefaction.
13. C. J. 3rd Aug., 1861.	Right side of heart filled with dark fluid blood. Brain much congested with dark fluid blood.	Larynx, &e., contained a large quantity of a clear watery froth. Lungs adhering by old adhesions.	Free from putrefaction.
14. J. M. 8th Sept., 1861.	Right side of heart contained a good deal of dark fluid blood.	Trachea filled with frothy mucus. Clear fluid in stomach.	No marks of external violence.
15. W. R. 4th Feb., 1862.		Trachea full of frothy mucus.	One or two slight bruises.
16. J. G. 7th Dec., 1861.	Vessels of brain, lungs and right side of heart, gorged with dark fluid blood.	Frothy mucus around nostrils. Food and water in stomach.	Slight putrefaction.

TABLE OF FIFTY CASES OF DROWNING—*(Continued).*

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
17. D. D. 21st Feb., 1862.	Lungs and brain congested. Right ventricle full of, and left contained a little, dark fluid blood.	Frothy mucus in lungs. Pint of watery fluid in stomach.	No marks of violence.
18. Child. 18th March, 1862.	Both sides of heart and veins on its surface distended with dark fluid blood. Brain and lungs congested.		Putrid.
19. J. J. 22nd March, 1862.	Right side of heart filled with dark fluid blood.	Trachea, &c., completely filled with clear water. Stomach distended with water.	Free from putrefaction.
20. D. M. 20th Jan., 1863.	Right side of heart filled, and left partially so, with dark fluid blood. Lungs gorged with dark fluid blood.	Water ran from mouth. Watery fluid in stomach.	No marks of violence.
21. E. N. 27th Jan., 1863.	Right side of heart filled with black blood. Left side empty.	Frothy mucus issued from mouth and filled the air-tubes. Water in trachea and stomach.	No marks of injury.
22. M. M. 15th Feb., 1863.	Brain much congested. Right side of heart and large vessels full of dark fluid blood.	Lungs much inflated with air. No water in trachea, bronchi, or stomach.	Quite free from putrefaction.
23. F. W. 22nd Feb., 1863.	Large vessels of right side of heart gorged with dark fluid blood.	Trachea filled with pure water. Large amount of water in stomach.	No marks of external injury.
24. J. S. 30th April, 1863.	Right side of heart distended with dark fluid blood. Right lung much congested.	Frothy mucus in lungs. Turbid water in stomach.	Slight putrefaction.

TABLE OF FIFTY CASES OF DROWNING—*(Continued).*

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
25. H. H. 7th May, 1863.	Heart and large vessels distended with dark fluid blood.	Lungs inflated, and not collapsing on exposure or pressure. Two ounces of a frothy fluid in stomach.	Free from putrefaction.
26. A. M. 13th July, 1863.	Heart and large vessels contain a good deal dark fluid blood. Vessels on the surface of brain congested.	Lungs much inflated, and not collapsing on exposure or pressure.	Free from putrefaction.
27. E. A. 23rd July, 1863.	Right ventricle of heart full of dark fluid blood.	Frothy mucus issued from mouth, and existed in small air-tubes of lungs. Watery fluid in trachea and stomach.	No marks of external violence.
28. G. O. 19th Aug., 1863.	Brain much congested. Heart quite empty. Large vessels distended with dark fluid blood.	Lungs inflated with air, not collapsing on exposure. Larynx, trachea, &c., contain water.	Putrefaction far advanced.
29. F. B. 11th Oct., 1863.	Heart and large vessels gorged with dark fluid blood.	Large quantity of frothy mucus around nostrils. Lungs filled with it. Trachea filled with pure water.	No marks of external violence.
30. G. T. 3rd Nov., 1863.		Froth issued from nostrils. Water in trachea.	No marks of external violence.
31. A. C. 23rd Nov., 1863.	Tongue protrudes. Heart and large vessels empty. Brain much congested.	Left lung collapsed. Right inflated; not collapsing on pressure.	Putrefaction considerable.
32. W. F. 9th July, 1864.	Brain congested. Dark fluid blood in heart and vena cava.	Larynx, &c., filled with water. Lungs collapsed on exposure. Six ounces water in stomach.	Free from putrefaction.

TABLE OF FIFTY CASES OF DROWNING—*(Continued).*

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
33. D. C. 26th April, 1864.	Right side of heart contained very dark coagulated blood adhering to walls. Brain much congested with dark fluid blood.	No frothy mucus or water.	Putrefaction far advanced.
34. A. M. 10th July, 1864.	Right ventricle full of dark fluid blood.	Frothy mucus in nostrils and large air-tubes. Watery fluid in stomach.	No marks of external violence.
35. J. P. 4th Aug., 1864.	Tongue protruded. Heart empty. Vena cava contained a little decomposed blood. Brain congested and much decomposed.	Larynx, &c., contain water holding in suspension the mud of the river.	Putrefaction far advanced.
36. N. D. 1st March, 1865.	Black blood in right ventricle; left, empty.	Frothy mucus filled air-tubes and issued from mouth. Watery fluid in stomach and trachea.	No marks of external violence.
37. A. S. 23rd April, 1865.	Left ventricle empty, and right gorged with dark fluid blood.	Frothy mucus issued from mouth and nose, and existed in small air-tubes. Trachea filled with water, and watery fluid in stomach.	No marks of external injury.
38. Child. 26th April, 1865.	Heart distended with dark fluid blood; aorta also contains a little. Brain congested on surface.	Lungs much inflated; not collapsing on pressure. Stomach contains some vegetable matter floating in a little water.	Quite free from putrefaction.
39. A. T. 24th July, 1865.		Trachea filled with a watery fluid.	Putrefaction far advanced.

TABLE OF FIFTY CASES OF DROWNING—*(Continued).*

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
40. T. S. 22nd Oct., 1865.	Heart empty. Venæ cavæ contain a little watery blood of a dark colour. Tongue protrudes.	Lungs, especially the right, inflated; did not collapse on exposure. Trachea contained a few bubbles of watery froth.	Free from putrefaction.
41. J. M. 27th Oct., 1865.	Heart contained dark fluid blood. Lungs crepitous and congested.	Trachea contained a watery fluid.	Natural.
42. A. T. 9th Nov., 1865.	Right ventricle contained dark fluid blood. Lungs crepitous, and contained dark fluid blood.	Trachea and stomach both contained a watery fluid.	Natural.
43. C. L. 3rd Nov., 1865.	Heart and large vessels distended with dark fluid blood. Lungs very slightly congested. Vessels and sinuses of brain gorged with dark fluid blood.	Lungs do not crepitate, and have a spongy feel. Mouth, larynx, &c., contain a good deal of frothy mucus. A little water in trachea, and a good deal escaped from œsophagus. No water in stomach.	Free from putrefaction.
44. B. B. 8th Dec., 1866.	Lungs congested. Heart filled with dark fluid blood.	Trachea filled with a clear watery fluid.	Healthy.
45. C. M. 8th March, 1866.	Heart empty. Brain and left lung congested.	Frothy mucus in air-tubes. Water in trachea. Water flowed from mouth.	Free from putrefaction.
46. W. S. 26th May, 1866.	Left ventricle contained a small quantity of black blood.	Frothy mucus issued from air-tubes and mouth. Water in trachea.	No marks of injury.

TABLE OF FIFTY CASES OF DROWNING—*(Continued)*.

Case and Date.	Signs of Apnœa.	Signs of Drowning.	Condition of Body.
47. J. G. 25th July, 1866.		Frothy mucus issued from mouth and nose, and existed in trachea and lungs.	Free from putrefaction.
48. M. M. 16th May, 1867.	Tongue protruded and compressed between teeth. Heart pale; no blood in it. Brain and lungs much congested.	No frothy mucus, or water, or mud.	Putrefaction considerable.
49. D. S. 23rd June, 1867.	Right side of heart distended with dark fluid blood. Right lung much congested.	Frothy fluid in bronchial tubes Fluid, smelling of whisky, in stomach.	Natural.
50. G. A. 2nd July, 1867.	Tongue protrudes. Heart empty. Small quantity of very dark blood in large vessels.	Frothy mucus in larynx and trachea. Water in bronchi. Lungs much inflated, and not collapsing on exposure or pressure.	Quite free from putrefaction.

The relative frequency of the signs of drowning, according to this Table, admittedly of little value, is as follows:—

Water in lungs,.....42 per cent.
Frothy mucus in lungs,.....46 per cent.
Balloon lung,.....20 per cent.
Water in stomach,.....38 per cent.

The following general conclusions may, I think, safely be drawn from the preceding statement of facts:—

1. That Taylor's opinion regarding the origin of frothy mucus in the lungs is correct.

2. That frothy mucus in the lungs, &c., has been very much overrated as a sign of drowning, and that in the best marked cases of drowning this sign is entirely awanting.

3. That hyperæria of the lungs and frothy mucus in the lungs are incompatible with each other as signs of drowning when the hyperæria is fully developed.

4. That in extreme hyperæria of the lungs persons may be *drowned* on the surface of deep water, and also in very shallow water, without being submerged.

5. That water in the stomach having properties the same as the water in which the body was found, and hyperæria of the lungs, are the best signs of drowning.

6. That any one of the four signs, occurring in connection with the signs of apnœa, is generally sufficient evidence to establish the fact of drowning. [1]

7. That goose-skin, retraction of the penis, &c., can only be considered as subsidiary to the other signs, and as of little value in themselves.

[1] The case of J. M'N., (case 64, page 52), is an apparent, but certainly not a true, exception to this general conclusion. His stomach contained a pint of ditch water associated with a large accumulation of dark fluid blood in the right cavities of the heart, the latter evidently depending on exposure to cold and not on apnœa.

CHAPTER II.

THE OBSCURATION AND OBLITERATION OF THE SIGNS OF DROWNING.

Obscuration and obliteration of signs by putrefaction, &c.—Of water in the lungs—Of frothy mucus—Of hyperæria—Of water in stomach—Of apnœal signs—Putrefaction a sign of drowning—General conclusions.

I have, in the former chapter, assumed that the investigation of the signs has been made soon after death, and before the occurrence of putrefaction. At this early period their investigation is always easy, and generally leads, I believe, to a satisfactory conclusion. But when, from whatever cause, the investigation has been delayed until the putrefactive process has been more or less developed, the signs, including those of apnœa, become more or less obscured, or even altogether obliterated, and thus a diagnosis is often rendered not only difficult and doubtful, but sometimes even impossible. It becomes then a question of great importance to determine the influence of putrefaction on the different signs. There are, however, other causes which, even in the recent body, may obscure and even obliterate some of the signs. Of these the most important is a careless handling of the body, allowing fluids to escape, both from the stomach and lungs, and wash away any frothy mucus they may meet with in their course. But putrefaction is by far the most important cause of the obscuration and obliteration of the signs. The following is a remarkable example of the complete obliteration of all the signs by putrefaction.

Case 51.

M. L., an old man found in the river Forth, on the 3rd of May, 1863. The body was very much decomposed, and had evidently been in the water for five or six weeks. Everywhere it was much discoloured and inflated. A bloody watery fluid was being discharged from the mouth and nostrils, and the face was so much decomposed that the features could not be recognized by his friends. The body was well clothed, and on removing his cap, which had been well passed over his face, all his hair came off along with it. There was no mark of external violence. The lungs were collapsed and free from congestion. The larynx, trachea, and bronchi were free from frothy mucus and water. The heart and large vessels were quite empty, and no blood, although carefully looked for, could be found anywhere in the body. The stomach contained eight hard, raw peas, unaffected by digestion, and nothing else, whether solid or fluid. The intestines were also quite empty. The gall-bladder contained a little bile, and the urinary-bladder a little urine. The brain was nearly fluid, and had a very fœtid odour. Its vessels, like the vessels of the body generally, were quite empty.

This case shows clearly a complete obliteration of all the signs. It shows, further, the impossibility of forming anything like a definite opinion as to the cause of death in such cases.

But cases of far advanced putrefaction are sometimes hastily abandoned as unfit for examination, which might, notwithstanding, have been proved to be cases of drowning. The following is an example of such abandoned cases.

Case 52.

D. R. was found in the river Endrick, on the 12th June, 1864. He was last seen alive on the 23rd January preceding. The bones of the cranium, of the right forearm, and of the left leg were completely denuded, and the body was a mere mass of putrilage. The reporters were of opinion that the body was utterly unfitted for dissection, and that no inference of the least value could be obtained from a further examination of it.

Now, in this opinion I cannot concur. It is well known that the fact of drowning, as shown by the following case from Casper, may be established even in the furthest advanced stages of putrefaction. "The dissection took place in the end of March. This man, aged twenty-four years, must, from the advanced stage of putrefaction, have lain in the water from four to five months at least (in winter), and yet this was a case in which it could be determined with certainty that the individual was drowned (alive when he fell into the water). The head was of a brownish coppery-red, the chest and upper part of the body green, the epidermis peeled off, the penis retracted, the brain putrid and anæmic. The lungs were so far advanced in putrefaction as to be no longer distended, but collapsed and anæmic. The large vessels and the heart still contained a little tarry blood. The trachea was of a brownish coppery-red, and empty, and nothing could be forced into it out of the lungs. The stomach contained nothing but *about half-a-teaspoonful of mud*, firmly adhering to its coats. The urinary-bladder contained about half-a-teaspoonful of urine; the vena cava still a little tarry blood. The interesting appearance found in the stomach could leave no doubt as to the nature of the death."[1] In all such cases, therefore, and in spite of complete putrefaction of the body, the stomach at least ought to be examined. There, in the absence of all the other signs of drowning, a certain diagnosis may still be found.

It thus appears that the amount or degree of putrefaction required to obscure or obliterate the signs is of very great importance, and in all cases demands a careful consideration. I shall therefore devote this chapter, primarily and chiefly, to an examination of the signs as they are affected by putrefaction, and, secondarily and incidentally, as they are affected by other causes. In doing so, I shall observe the order followed

[1] Handbook, vol. ii., case 311, p. 257.

in the preceding chapter when considering the characters of the different signs.

1. *Water in the lungs, as affected by putrefaction, &c.* It is impossible to see how this sign could be affected by putrefaction. If it is ever obliterated then, it must be in some other way than this. Now the only other ways in which this could be done are by the mechanical escape of the water, from the body being carelessly placed in a position favourable for this, and by its absorption into the general tissues of the body, and ultimate escape from them under the influence of evaporation. That this sign is sometimes lost in both of these ways there can be no doubt. Taylor, treating of the loss of frothy mucus, says:—"If the body is removed from the water with the head depending, any fluid which may be contained in the lungs will escape, and, passing through the air-passages, this fluid will effectually obliterate the frothy appearance."[1] It will itself also be thus lost as a sign of drowning. Every person who has had any experience in such cases, must admit that water in the lungs may be lost by absorption into the tissues and evaporation from them, after the body, ejected from a tidal river or even floating on the surface of water, has been exposed to atmospheric influence for some time. The sign, then, may be lost in either of these ways. Its loss certainly can never be ascribed to putrefaction. Indeed, it is often found in the lungs of bodies much decomposed, as in cases 28, 35, 39, of the Table.

2. *Frothy mucus in the lungs, as affected by putrefaction, &c.* Casper, who invariably mixes up and confounds this sign with the sign of hyperæria, says:—"Alas, this most exquisite sign disappears during putrefaction, and if that be in any degree advanced, both trachea and bronchi are found quite empty."[2] Now I am quite satisfied, notwithstanding

[1] Taylor, p. 728. [2] Handbook, vol. ii. p. 239.

of this high authority to the contrary, that the disappearance of frothy mucus has no connection whatever with putrefaction as its cause. Taylor says that frothy mucus is rarely seen after several days, and that, as I have already stated, it may entirely disappear while the body is being incautiously handled. Devergie states, that in winter it can be discovered in most cases during eight or ten days; and Orfila, somewhat vaguely, that if the bodies had been in the water for a few hours only it was present, but not so if they had been in it twelve or fifteen days. I have heard the escape of frothy mucus from the lungs of a person recently drowned compared to the escape of carbonic acid gas from recently drawn beer or champagne; and thus making it a purely mechanical phenomenon altogether independent of putrefaction. From all this, I think it follows that the sign is generally lost before the occurrence of putrefaction. Casper, I repeat, in ascribing its loss to putrefaction, has, as usual with him, confounded the two distinct, although occasionally co-existent, signs of frothy mucus and hyperæria.

3. *Hyperæria of the lungs, as affected by putrefaction, &c.* This sign is, with the exception of water, and especially foreign matter in the stomach, the most enduring of all the signs of drowning; and its loss is, I believe, invariably due to putrefaction. The air pent up in the over-distended lungs can only, it would appear, be liberated from them by a far advanced stage of putrefaction. It is only then that the tissues of the lungs give way and permit the air to escape. Its mode of escape is not known, and I am not in a position to offer any information on the subject. The fact, however, is undoubted, that the balloon lung, after resisting every attempt to reduce it, will, when putrefaction has reached a certain stage, not well defined, part with its air and collapse. Of this we have a good example in case 31 of the Table, where one lung was perfectly

empty and collapsed, and the other still in the condition of hyperæria not reducible by pressure. This child, aged twenty months, fell into the river Allan, on the 19th of October, 1863, near to the village of Kinbuck. Its body, after being carried down the river for a distance of six miles, was found half a mile below the Bridge of Allan, on the 22nd November following, so that it had been in the water thirty-four days. It was examined on the day after it was found, and the body then, as stated in the Table, was considerably putrefied. But there is reason to believe that the balloon lung will stand a much higher degree of putrefaction than this, as in case 28 of the Table, where it was still present, although the body was in a state of far advanced putrefaction. It is, beyond all doubt, one of the most enduring of the signs. Casper, again confounding it with frothy mucus, calls it an "exquisite sign."

4. *Water in the stomach, as affected by putrefaction, &c.* Water in the stomach, like water in the lungs, cannot be affected by putrefaction. It may, however, like it, be lost by careless handling, and also by absorption into the general tissues and subsequent evaporation from them. In case 43 of the Table, a large quantity of water escaped from the œsophagus during the inspection of the body, and afterwards no water was found in the stomach, or any indication that it had ever been there. The case quoted from Casper, page 33, shows that water received into the stomach during the act of drowning may be lost by absorption into the tissues, and by evaporation from them under atmospheric causes. The teaspoonful of mud found in the stomach, and of itself sufficient to diagnose the case, could only have been conveyed into the stomach suspended in the water in which the man was drowned. This sign, as I have already said, is not only the most valuable but also the most enduring of all the signs of drowning, and is never in any way affected by putrefaction.

5. *The Apnœal signs, as affected by putrefaction, &c.* The apnœal signs, although they cannot be considered as direct signs of drowning, nevertheless require some notice in this place, as they are affected by putrefaction. They chiefly consist of an accumulation of dark fluid blood in the right cavities of the heart and large blood-vessels connected with these cavities, and of congestion of various internal organs. The behaviour of these accumulations of dark fluid blood, especially in the right cavities of the heart and large vessels, under putrefaction, is of very great importance, and necessarily and always demands much attention from the medical jurist. I have already shown, in case 51, and probably also in case 52, that under far advanced putrefaction they disappear altogether. This is likewise clearly shown in cases 28, 31, and 48 of the Table, where no blood whatever was found in the heart and large vessels. But sometimes, in cases of far advanced putrefaction, a little blood, always however much altered in its character, is occasionally found in them. In the case, for example, quoted, page 33, from Casper, a little tarry blood was found in the heart and large vessels, the body having been in the water from four to five months. Similar alterations of the blood by putrefaction, more or less advanced, are shown in cases 33, 35, and 40, of the Table. The blood then, dark and fluid, accumulated in the right cavities of the heart and large vessels, appears to be readily affected by putrefaction; and its decomposition, doubtless, is the chief source of those gases which inflate the body often to a colossal size, and render it buoyant on the surface of water.

But putrefaction, however much it may obscure and obliterate the signs, has itself been made, especially by French medical jurists, a sign of drowning. This supposed sign rests on the fact, acknowledged, I believe, by all medical jurists, that in bodies found in water putrefaction first begins in the head and then proceeds *downwards*, whilst in bodies found in

any other medium, as in air or earth, it first begins in the abdominal coverings and from them afterwards extends itself *upwards and downwards.* Casper says, "That this peculiar march of putrefaction depends not upon the kind of death, but on the position of the body in the water, so that it is also found in bodies which have fallen or been thrown into the water after death."[1] It is not then a sign of drowning, but merely a sign of putrefaction having taken place in water. It is a sign that the body, whether dead or alive, was in a fresh and undecomposed state when it fell or was thrown into the water.

From the foregoing statement of facts it follows:—

1. That hyperæria and the apnœal signs are the only signs of drowning obliterated by putrefaction.

2. That frothy mucus and water in the lungs are obliterated by the escape of the water when favoured by position, and by evaporation and absorption into the tissues of the body.

3. That the blood suffers early and complete decomposition, and is the chief source of those gases which inflate the body and render it buoyant.

4. That water in the stomach is obliterated by careless handling, and by absorption into the tissues and subsequent evaporation from them, leaving behind it any solid foreign matter it may have held in suspension.

5. That even in the furthest advanced stages of putrefaction, the stomach, heart, and large vessels ought always to be examined, as in them certain and decisive evidence of drowning may yet be found.

6. That the origin and progress of putrefaction in a dead body found in water, although it may show that the body when it fell or was thrown or carried into the water was in a fresh and undecomposed state, is not a sign of drowning.

[1] Handbook, vol. ii. p. 262.

CHAPTER III.

THE DIAGNOSIS OF DROWNING ILLUSTRATED BY CASES.

Diagnosis of Drowning—Post mortem appearances its only basis—Correlation of signs of apnœa and of signs after exposure to cold—Diagnosis illustrated by cases—Cases of ordinary drowning—Cases of drowning in shallow water, &c.—Cases in which the question of drowning was raised—General conclusion.

I have placed the diagnosis of drowning on what I consider its true basis, namely, on a consideration of the signs of drowning taken in connection with the signs of apnœa as they both exist in the body under examination. The medical jurist engaged in so important a duty should be careful not to admit any fact really extraneous to it as an element in the diagnosis. The fact that a body has been found, either floating on or sunk in deep water, is not, *per se*, evidence of drowning. The fact that a body has been found, either floating on or sunk in shallow water, is not, *per se*, evidence of the application of criminal violence, even although it may be afterwards proved that the person was drowned. The fact that a person was seen to die floating on the surface of deep water without being submerged, is not, *per se*, evidence that death was caused by apoplexy or general neuroparalysis, and not by drowning. Such facts as these, however valuable they may be to the general evidence, are really worthless in establishing the diagnosis of drowning. The diagnosis of drowning, I repeat, should rest entirely on the *post mortem* appearances in the body under examination. But there is a fact, pathological, and altogether different from the facts I have just enumerated, that has an important bearing on the

diagnosis of drowning. I allude here to medico-legal cases of very frequent occurrence in this country, which simulate very much the *post mortem* appearances of apnœa. This simulation occurs in persons found dead after exposure to cold during intoxication. The following is an example:—

Case 53.

D. M'D., reported as 33 years of age, and as having been found dead on the road leading from Aberfoyle to the Trossachs, on the 28th February, 1866. The body, examined on the 2nd March, was in good condition and quite free from putrefaction, although the *rigor mortis* was nearly gone. The pupils were slightly dilated. There was a very slight abrasion of the cuticle on the right knee. The lungs collapsed on exposure, and were free from congestion. Both sides of the heart were distended with fluid blood, the blood in its right cavities being of a dark colour. All the abdominal organs were quite healthy, but very much congested, especially the liver. The gall-bladder and urinary-bladder were both distended. The brain was intensely congested, and a large quantity of blood escaped from the sinuses during the examination.—This man left Aberfoyle very much intoxicated on the evening preceding his death, taking with him a further supply of whisky in a bottle, some of which had been used. The weather was not intensely cold, but cold enough, it would appear, with the depressing influences of the whisky, to produce death.

The correlation of the signs of the apnœa of drowning and of death after exposure to cold during intoxication, sometimes, especially when a body has been found in a river or ditch, embarrasses the reporter and complicates very much the investigation of the case. This difficulty, however, may, I believe, be always obviated by a careful comparison of the respective signs of these two distinct causes of death. In death after exposure during intoxication, the congestion is always more generalized and more intensified than in apnœa. The congestion of exposure during intoxication seems to fall with great severity on the brain and sinuses, from which the

discharge of blood is always enormous; and this of itself is often sufficient to characterize the case. In addition to this sign, the right cavities of the heart and large vessels are comparatively free from blood distension; and the blood in these cavities and vessels, although equally or perhaps even more fluid, is not so dark as it is in apnœa. It thus appears, that in death after exposure to cold during intoxication, the brain and sinuses are chiefly gorged with dark fluid blood: in death by apnœa, the right cavities of the heart and large blood-vessels.

The fact, then, that the *post mortem* appearances in persons found dead after exposure to cold during intoxication simulate the *post mortem* appearances of apnœa, does not affect in any way the position I have assumed, that "the diagnosis of drowning should rest entirely on the *post mortem* appearances in the body under examination." The following diagnoses, all of them made by authority, were arrived at entirely on this principle. I shall divide the cases into three classes:—I. Cases of ordinary drowning. II. Cases of drowning in shallow water, the persons being incapacitated for physical effort, either by accident or disease. III. Cases in which the question of drowning was raised, but which proved to be cases of exposure to cold during intoxication, or of suffocation, &c.

I. *Cases of Ordinary Drowning.*

Case 54.

The body of a boy, apparently seven or eight years of age, was examined at Falkirk on the 23rd July, 1854. The following is the report, which I give *in extenso*:—"Our attention was first drawn to a well in the garden, immediately adjoining the house, out of which the body was reported to have been taken on Thursday last, July 20th. We found this well covered over with thick planking, leaving a circular opening at its north-east end, fourteen inches in diameter, and approaching to within six inches of the cradling of the well. The well itself was somewhat oval in shape, being

3 feet 5 inches in its short and 3 feet 8 inches in its long diameter. It was 8 feet 7 inches in depth, of which 4 feet 1 inch were occupied by water. The stones composing the cradling were very irregular in shape, and were carelessly put together, affording many ledges, upon which a person's feet might easily rest, or which the hands might lay hold of. Eight of these ledges, from the surface of the water up to the opening mentioned, bore distinct marks of having been used apparently by the feet of some person.

On examining the body, we found its length, from the heel to the crown of the head, 3 feet $9\frac{1}{2}$ inches. On extending the arms in a line with the body, the length from the ends of the toes to the tips of the fingers was 4 feet $9\frac{1}{2}$ inches. When the arms were extended at right angles to the body, as it lay on the table, the measurement was 3 feet $7\frac{1}{2}$ inches from the tips of the fingers to those of the opposite side. Breadth across shoulders, 12 inches.

The general appearance of the body was pale, the dependent portions being somewhat livid. The nails of the fingers were of a dark violet colour; nails of the toes not particularly discoloured; skin slightly bluish over the balls of the thumbs, and on the outside of both little fingers; no blood was found effused into any of these when cut into. On the back of the left wrist a yellowish discoloration was observed, about an inch broad and an inch and a half in length. On the left shoulder there was a discoloration of nearly the same size and character, and both these discoloured portions, when cut into, showed the cellular tissue similarly discoloured, proving them to be ecchymoses, but without question of several days' standing. On the first phalanx of the left thumb there was a superficial cut of about half an inch in length, dry, but without any scab on it. A nearly circular abrasion was observed on the point of the chin. The tongue slightly protruded between the teeth, and was of a livid colour; inside of lips and eyelids of nearly same colour; cornea dim, and pupils much dilated. Some dark-coloured mud was found in both the mouth and nostrils. Two dark blue marks were observed on the left side of the forehead, each about half an inch in diameter; and on reflecting the scalp, nine spots were also found between the crown of the head and the occipital protuberance, each about half an inch in diameter, having blood effused into the cellular membrane. Some of these felt firmer and thicker than the healthy skin around them. The spots observed on the forehead were now also cut into, and were found

infiltrated with blood; and the whole of these infiltrations, anteriorly and posteriorly, were evidently of a recent character. No injury of the skull was observed, and the brain was healthy. About two ounces of dark fluid blood escaped in cutting through the skull at its posterior portion. On reflecting the integuments of the abdomen, the muscular tissue was observed to be of a darker red than usual. On opening the chest, the viscera were found healthy. All the cavities of the heart, as well as the aorta, were completely empty, and only a small quantity of dark fluid blood was found in the lower vena cava. The upper portions of the lungs, as the body lay on the table, were also found nearly empty of blood; the lower depending portions were somewhat congested. The trachea, when cut across, was filled with a frothy bloody fluid. The viscera of the abdomen were healthy, but were of a darker colour than usual; and the liver particularly was dark in colour externally, being distended with dark fluid blood, which flowed freely from it when an incision was made into it. On opening the stomach a considerable quantity of food was found, composed in great part of young peas, scarcely altered in consistence or appearance. Some very dark-coloured mud, having almost the appearance of coaly matter, was found in the stomach. Upon dragging the bottom of the well in the garden formerly referred to, abundance of black mud was found, apparently identical with that found in the stomach." [1]—*(MS. Report.)*

No diagnosis of the case is given in the report. There can be no doubt whatever that death was caused by drowning. The frothy bloody fluid in the trachea, and the black mud in the stomach, occurring in connection with the signs of apnœa, establish this fact. There must have been some water in the stomach, the water of the well conveying the black mud into the stomach during the act of drowning. Perhaps it was afterwards lost by a careless handling of the body.

[1] This able and carefully prepared report was drawn by a distinguished physician in Falkirk. All the other cases used to illustrate the diagnosis of drowning in this chapter occurred in my father's practice, or in my own practice. If the diagnosis of drowning is restricted to the *post mortem* appearances, the relative length of limbs and relative depth of water in which the body was found must lose necessarily much of the importance hitherto attached to them.

Case 55.

P. L., reported as two years old, and as having been found dead in a well on the 23rd November, 1868. The body is obese, and in excellent condition. The *rigor mortis* is still present, and the fingers are very firmly contracted. The pupils are slightly dilated. The tongue does not protrude. The penis is not retracted. There is no frothy mucus in the nostrils or mouth. Everywhere the body is quite free from lividity. There are no marks of external violence. The chest sounds well on percussion. The lungs are a good deal inflated, and nearly cover the heart. They cannot be reduced by pressure, but are feebly crepitant. They are free from water, but there is a very little frothy mucus in the bronchi. The right cavities of the heart and the large vessels, the cavæ and pulmonary artery, are distended with very dark and very fluid blood. The pericardium contains a little serum. The stomach contains about a pound of a pultaceous mass, evidently composed of the ordinary ingredients of broth, suspended in a very little pure water. The bladder is quite empty, and so very small and firmly contracted as to lead a gentleman present to compare it to the uterus of a child. The kidneys and liver are slightly congested. The brain is very much congested, and the sinuses are filled with very dark fluid blood. There is a good deal of serum in the ventricles and base of the cranium.

This case is chiefly remarkable for the slight development of the signs. The external signs were entirely awanting, and the internal signs consisted merely of an imperfect hyperæria and a very little frothy mucus in the bronchi. These, however, taken in connection with the apnœal signs, remarkably well developed, left no doubt in my mind as to the character of the case. The child went out after getting its dinner, and in a very short time afterwards was found in the well. Every effort was made by a surgeon in the neighbourhood to restore animation.*

Case 56.

J. D., aged 46, was found dead in the river Devon, near Alva, on the 6th February, 1869. The body was emaciated,

* See Appendix G.

but otherwise in good condition, and quite free from putrefaction. The pupils were normal. There was a great escape of water, free from froth, from the mouth. The penis was small and retracted. There was a contusion, evidently inflicted *post mortem*, on the upper part of the forehead. There were no other marks of external violence. The lungs were much distended, but crepitous, and easily reduced by pressure. The larynx, trachea, and bronchi were quite full of clear water. The heart was enlarged by hypertrophy, especially of the left ventricle. Everywhere it adhered to the pericardium, and there was a great deal of old false membrane deposited on it. Both sides of the heart were distended with very dark and very fluid blood. The stomach was quite full of clear water. The urinary-bladder was quite empty. The brain was much congested, and the sinuses were distended with very dark and very fluid blood.

The remarkable feature of this case is, that the distension of the lungs depended more on an enormous accumulation of water in them than on hyperæria. The lungs not only covered the heart, but pressed everywhere firmly against the ribs, so as to completely fill the chest. They were, notwithstanding, highly crepitous, and when compressed, a large quantity of clear water, free from froth, flowed freely from them into the trachea. The body was a week in the river, and it is quite possible the water may have entered the lungs after death. There was no sign of hyperæria, other than the distension of the lungs. Could the water have dislodged the air of an imperfect hyperæria after death?

Case 57.

Stirling, 22nd June, 1869.—M. F., reported as 51 years of age, as having been found in the river Forth on the 20th instant, and as having been absent from home since the 12th instant. Putrefaction has made considerable progress. The body is everywhere much swollen and discoloured, but especially on the face and head, and the features are completely lost in the swelling and discoloration. There are no marks of external violence. The lungs are free from hyperæria. The larynx, trachea, and bronchi contain water and some watery

froth. The right cavities of the heart contain some tarry-looking blood adhering everywhere to their walls. The left cavities and large vessels are empty. The pericardium contains half-an-ounce of bloody serum. The abdominal organs are all healthy. The stomach contains four ounces of clear water having a few very small pieces of bread floating in it; and during the inspection, a little clear water escaped from the œsophagus. The urinary-bladder is empty. The brain and cerebellum are very much congested, and the sinuses are filled with dark fluid blood. The ventricles are filled with bloody serum.

The only thing noticeable in this case is the rapid advance of putrefaction and decomposition of the blood. The woman left her home only ten days before the inspection of her body.

Case 58.

Stirling, 6th June, 1870.—N. M., reported as 49 years of age, as having been found floating in the river Forth on the 5th instant, and as having been last seen alive on the 27th ultimo. The body is very much discoloured and inflated. The face is quite black, and the features are quite lost in the swelling and discoloration. The abdomen and chest and upper parts of both arms and both thighs are green; and at the lower part of the abdomen the cuticle is peeled off. There are no marks of external violence. The lungs are inflated, but crepitous and easily reduced. There is no water or frothy mucus in the larynx, trachea, or bronchi. There is a large quantity of bloody serum in both sides of the chest, and an ounce of similar serum in the pericardium. The ascending cava is full of very dark and very fluid blood, but the right cavities of the heart and pulmonary artery have only a very little dark tarry blood adhering to their walls. The stomach contains four ounces of muddy water similar to the water of the Forth, and nothing else. The urinary-bladder is empty. The superficial veins of the brain are much congested with fluid blood, but the sinuses are quite empty. There is a little bloody serum in the ventricles.

This case, like the last (case 57), is only remarkable for the rapid advance of putrefaction. He was last seen alive on the 27th of May, only nine days before the inspection of his body.

It is reported that N. M. had invented an aquatic velocipede, and it is very probable that he lost his life while privately testing its powers in the river Forth.

Case 59.

D. S., a young man of weak intellect, was found dead on the banks of the Touch Burn, on the 8th of August, 1838. His body was brought into Stirling, and examined on the day following. It was generally believed, in consequence of the lower jaw being very severely fractured and the presence of a wound on the upper part of the forehead, that he had been murdered. The injuries to the jaw and on the forehead were quite free from ecchymosis and clots, leaving no doubt whatever of their infliction after death. The right cavities of the heart and the large vessels connected with them were distended with dark fluid blood, and the lungs were a good deal inflated. There was also some frothy mucus in the trachea, and a considerable quantity of pure water and blae-berries *(Vaccinii Myrtilli fructus)* in the stomach. The body was in good condition and quite free from putrefaction.

The Touch Burn, when in flood, is a rapid and brawling stream of considerable volume, with several falls in it, one especially, Gilmore's Linn. No doubt the injuries were inflicted while the body was being carried over one of these falls. The injury on the upper part of the forehead was submitted to Dr. Christison, who corroborated the opinion given in the report, as to the period and probable mode of its infliction.

II. *Cases of Drowning in Shallow Water, the persons being incapacitated for physical effort either by accident or disease.*

Case 60.

E. P., examined 11th June, 1866. She was reported as 62 years of age, and as having been found lying on her face in the Garrel Burn, near Kilsyth. The body was in good condition and quite free from putrefaction, the *rigor mortis* being still present. The fingers were firmly contracted, and there was a good deal of sand under the nails. The

pupils were slightly dilated. There was a contused wound, two inches in length, near the crown of the head, penetrating to the pericranium. The larynx and trachea contained a good deal of frothy mucus, and the bronchi a good deal of water. The lungs were quite healthy, and did not collapse on exposure. The right cavities of the heart and large vessels were distended with very dark fluid blood. The heart was very fatty, but not enlarged. The aorta, however, was much dilated, and formed a large pouch at its commencement. The valves were healthy. The stomach was quite empty, and had a slight spirituous odour. The mucous membrane near the cardiac orifice was congested. The intestines were quite empty, with the exception of a little feculent matter in the rectum. The liver was normal and free from congestion. The gall-bladder contained six angular gall-stones of a dark colour, floating in a fluid bearing no resemblance to ordinary bile. The urinary-bladder was empty. The other abdominal organs were healthy. The neck was found to be dislocated between the third and fourth vertebræ, and the parts around this injury were infiltrated with blood, some of which had formed small but distinct clots. On reflecting the scalp, four clots were found under the pericranium near the external wound on the crown of the head. The brain was much congested, especially in its posterior lobes, and there was a good deal of serum effused under the arachnoid and into the ventricles. The cerebellum was also much congested.

The cause of death in this case was no doubt of a complex character, depending on injury of the spine and immersion of the face in water, when the woman was utterly disabled for physical effort. She was last seen alive in company with another old woman, both being very much intoxicated, on the day before her body was found in the Garrel Burn, at the base of a rocky precipice, over which she must have fallen on her head, injuring it on the crown and dislocating the neck. That respiration was continued after the fall into the burn is proved by the partial hyperæria, the frothy mucus in the larynx and trachea, and the water in the bronchi.

Case 61.

J. A., aged 30, was found dead in Glenogle Burn, near Killin, lying on his face in fourteen inches of water, on the

7th January, 1869. The body was in excellent condition, very muscular and robust, and quite free from putrefaction. The *rigor mortis* had nearly passed off, but the fingers were still firmly contracted. The pupils were dilated. The tongue did not protrude. The penis was not retracted. The mouth and nostrils were free from frothy mucus. The head was remarkably loose and mobile, and easily rolled about. There were, however, no marks of external violence. The lungs were slightly inflated, but they were highly crepitous and very easily reduced by pressure. There was a little clear watery froth—the watery bubbles of Devergie—in the trachea, but none elsewhere. The heart was twice its normal size, the enlargement depending on dilatation of all its cavities. It was everywhere very fatty and soft. All the cavities, but especially the right, were distended with dark fluid blood, and in the right ventricle there were some small clots. The pericardium contained half-an-ounce of serum. The abdominal organs were all healthy. The stomach contained half-a-pint of pure water, in which a few pieces of half-digested potatoes were suspended. It was quite free from spirituous odour. The liver was much congested. The urinary-bladder was distended. The brain generally was congested, and the blood in the sinuses was dark and coagulated. There was a good deal of serum in the ventricles and base of the cranium. There was also some serum effused under the arachnoid; and in some places this membrane was thickened and opaque. After a careful dissection, the neck was found dislocated between the first and second vertebræ. The reporters, of whom I was one, give no definite opinion as to the cause of death. They offer, however, the following remarks:—"The cause of death in this case is evidently complex. The dislocation of the neck, and the watery froth found in the trachea, show that death may have been caused by immersion of the face in water subsequent to the dislocation of the neck. In the presence of these facts, we cannot give much importance to the diseased condition of the heart as the proximate cause of death."—*(MS. Report.)*

I conducted this inspection, and at the time, I had no doubt whatever that the man was alive when he found his way into the burn. The watery froth in the trachea, and the pure water in the stomach, prove this. These facts, taken in connection with the large accumulation of dark fluid blood in

the heart, leave no doubt that death was chiefly caused by the apnœa of drowning. Yet, there is some peculiarity in the character of the blood, for there were some small clots in the right ventricle, and the blood in the sinuses was not only dark but coagulated. The following sequence of events is probably the true cause of the man's death. In crossing the burn, the action of the heart may have given way, causing him to fall; during which his neck was dislocated and his face immersed in the water, the dislocation of the neck rendering him incapable of all further physical effort. Hence the drowning.

Case 62.

W. M. K., aged 28, a farmer, and very intemperate, left home quite sober on the 23rd April, 1868, and was soon thereafter found dead in a drain on the farm of New Mills, lying on his face in two inches of water. The body, examined by me on the 25th, was in excellent condition and quite free from putrefaction, the *rigor mortis* being still present. The left pupil was contracted, and the right normal. There were no marks of external violence, with the exception of a slight abrasion of the cuticle on the nose. The lungs were quite healthy, but a little congested. They collapsed on exposure, and were crepitous. There was a great deal of frothy mucus in the larynx and trachea. The heart was fatty, especially over the right ventricle. The left ventricle was very much hypertrophied; and the right cavities and large vessels were very much distended with very dark and very fluid blood. The stomach was healthy, and contained four ounces of a greyish watery fluid, having some solid matter floating in it, evidently minced meat and potatoes, not much altered by digestion. The liver was enlarged, indurated, and granular; and very pale and bloodless. The kidneys were much congested. The other abdominal organs were all healthy. The gall-bladder was distended: the urinary-bladder empty. The veins and sinuses of the brain were distended with dark fluid blood, and there was an enormous effusion of serum under the arachnoid and into the ventricles. The arachnoid was thickened and opaque.

The death of this man was evidently caused by apnœa. He had been long liable to "weak attacks," probably the

petit mal, and his friends supposed that in one of these attacks he had fallen on his face in the drain while attempting to get a drink from it. The *post mortem* appearances support this opinion. The thickened and opaque condition of the arachnoid, and the enormous effusion of serum under it and into the ventricles, prove that he had long laboured under disease of the brain, the cause, no doubt, of his "weak attacks." That his death was caused by the apnœa of drowning is placed beyond all doubt by the frothy mucus in the larynx and trachea, and the great distension of the right cavities of the heart and large vessels with dark fluid blood. This case does not differ much from an ordinary case of suffocation; only in the suffocating medium being water. *

III. *Cases in which the question of drowning was raised, but which proved to be cases of exposure to cold during intoxication, or of suffocation, &c.*

Case 63.

D. M'D., reported as having been found in the river Endrick on Monday the 8th, and as having been last seen alive on Friday the 5th December, 1856. It was also reported that the body when found was quite naked, with the exception of his shirt, which, turned inside out, was hanging by one of his wrists, and that all his other clothes, also turned inside out, were found in various parts of the river. The face was a little swollen and discolored, but the body generally was in excellent condition and free from putrefaction. There were several slight wounds on the upper part of the forehead, under and around which several clots of blood were found. The bones of the nose were fractured, and there were several contusions on the front part of both legs. The lungs collapsed on exposure, and were very much congested. The larynx, trachea, and bronchi were free from water and frothy mucus. The stomach was quite empty. The right cavities of the heart and large vessels were much distended with dark fluid

* See Appendix H.

blood; and the abdominal organs generally were very much congested. The brain was also very much congested.

No opinion as to the cause of death is given in the report, but this is afterwards brought out in a precognition so rare and curious that I am tempted to transcribe it:—

"The wounds described in the report were inflicted during life. This I infer from the clots connected with the wounds and the areolæ around the contusions. The wounds were not of a mortal character or sufficient to cause death. From their number, character, and situation, I think it is likely they were caused by falls forward. Assuming that he was intoxicated and exposed to very cold and inclement weather on Friday, the 5th, I am of opinion, if he lay down to sleep in such circumstances, that his death might have been caused by exposure to intense cold. This is a very frequent cause of death in this country, and I have often met with such cases. The usual appearances of drowning are entirely awanting, and I am of opinion that the man was not drowned. The injuries may have accelerated his death. His death, I have no doubt, was caused by exposure to cold during the collapse of intoxication. I am of opinion that the man was dead before his body was carried into the river. I infer this altogether from the *post mortem* appearances. I am aware that men in a state of drunkenness often take off their clothes in the open air, even in the coldest weather, imagining that they are at home and going to bed. I have myself known of such cases. The fact communicated to me that all his clothes were found in the river turned outside in, and that his shirt, also turned outside in, was only attached to the body at one wrist, corroborates the opinion I have of this case, that the man himself had taken off his clothes while in a state of drunkenness, and put himself to bed, as it were, on the banks of the river. The river rising after his death, swept both body and clothes

into it, and carried them all down to the various places in the river where they were found."—*(MS. Precog.)*

It was proved in evidence that the Endrick rose suddenly on the night in question and overflowed its banks.

Case 64.

J. M'N., aged 58, reported as having been found dead leaning against the side of a deep and narrow ditch, in a sitting position, on the farm of Springfield, in the parish of Campsie, on the 26th February, 1867. The water in the ditch reached to the middle of the body only, leaving the head and upper part of the chest completely exposed. The body was a good deal emaciated; and there was a plaster on the right shoulder and another on the right hip. The pupils were quite natural. There were no marks of external violence. The lungs were quite healthy, and collapsed on exposure. They were quite free from water, frothy mucus, and hyperæria. The heart was enlarged, and very fatty all over its right cavities. These cavities were distended with dark fluid blood, and there was a little serum in the pericardium. The stomach was quite healthy, and contained about a pint of a dirty watery fluid—evidently ditch water—having a slight spirituous odour. The intestines were healthy. The gall-bladder and urinary-bladder were both distended. The spleen was remarkably small and pale. The liver was enlarged and pale. All the other abdominal organs were healthy. The brain was very much congested on its surface, and there were several large congested patches in the dura mater. The veins and sinuses were gorged with blood, from which a very large quantity escaped during the inspection. The ventricles were distended with serum, and there was also a little serum effused under the arachnoid.

I have already alluded to this case in a note at page 30. There can be no doubt that it is a case of death from exposure to cold during intoxication. There is certainly no distinct evidence of drowning, for the pint of ditch water found in the stomach, even when associated with the dark fluid blood in the right cavities of the heart, cannot, in the absence of all the thoracic signs, be held as decisive of this. The congestion,

too, fell with great severity on the brain and sinuses, indicating rather the congestion of exposure than of drowning. It is more than probable, that while attempting to get a drink from the ditch he fell into it, and then, losing all control of himself by his strength failing him, he could not get out of it again. Or he may have, during his intoxication, fallen accidentally into the ditch and then swallowed the water during the shock of immersion. In either case, he must have regained strength sufficient to place himself in a position safe from drowning, but not sufficient to enable him to get out of the ditch.

Case 65.

J. R., a mason, aged 25, was found dead on the 25th March, 1859, in a rivulet or burn on the farm of Braeval, in the parish of Aberfoyle. The body was found lying on its back, with the head down the burn and the feet in a conduit under a wall through which the burn flowed. The burn, for the space of about six feet where the body lay, was narrowed, and here it was not more than sufficient to admit the body. The burn was shallow, and, as the body lay in it, the water did not rise above the ears and sides of the body, leaving the face and upper parts of the chest and abdomen uncovered. The body was examined on the 28th by two surgeons, and the following is the substance of their report of the *post mortem* appearances observed by them, stated in their own language. Externally, they found "one large contused bruise upon the left temple, about two inches in length and one inch in breadth," and "another contused bruise on the left side of the neck, an inch in length and an inch and a half in breadth." They found also slight "abrasions" all over the head, but more particularly over its left side, some slight scratches on the back of the fingers and hands, the pupils "widely dilated," and blood flowing from the left ear. The brain was much congested, and on removing the dura mater, "two ounces of extravasated blood gushed directly from the left side of the head." The brain and lungs were much congested. "The right compartments of the heart were congested, and there were coagula in the left ventricle." "The liver was highly congested. The contents of the stomach were fluid, and about six ounces in measure."—*(MS. Report.)*

The reporters could not agree in opinion as to the cause of death. One of them would have it that the man had been murdered and afterwards placed in the burn by his murderers, whilst the other, a young and intelligent surgeon since dead, declining to take this view of the case, refused to sign the report. The report, consequently, was submitted by the authorities to my father for his opinion on it. This he declined to give. He offered, however, to give an opinion on the whole case, provided he was allowed to examine the body as it was left by the reporters. This was at once conceded, and the body was exhumed and re-examined at Doune on the 31st, in the presence of the sheriff and procurator-fiscal of the Western District of Perthshire, and of the two reporters. No written report of this examination was required, a precognition, "based on the first report," being preferred by all the parties present. The following is the precognition somewhat abridged :—

"Before proceeding to examine the body, I perused the report dated 28th March, 1859. After carefully examining the body of the deceased, I found the following external appearances :—A contusion with distinct ecchymosis on the left side of the forehead, two inches in length and one inch in breadth. The cuticle of the left external ear a good deal abraded, especially behind. A great many very small circular abrasions without ecchymosis all over the head and face. A slight contusion with ecchymosis on the left side of the neck, half an inch in length. A contusion with abrasion of the skin on the knuckle of the middle finger of the left hand. A number of slight scratches on the back of both hands. The fingers firmly contracted. The pupils very much dilated. The body very muscular and robust, and free from putrefaction. The ordinary incisions of a *post mortem* examination. The body carefully washed, and no appearance of a discharge of blood from the left ear. On undoing the

stitches on the head there was a large escape of blood of a dark colour, and the brain and sinuses were still quite gorged with dark fluid blood: no fracture or fissure could be detected in the cranium. The lungs were very much congested at their lower or back part, and there was a great deal of blood in the chest, effused from the heart and large vessels during the previous examination. There was no water or frothy mucus in the larynx, trachea, or bronchi, and no hyperæria. The organs of the abdomen were all quite healthy. The liver was congested. The stomach had been removed. The urinary-bladder was distended, and the gall-bladder contained a little bile. The spine was carefully examined and found to be uninjured and free from disease. All the organs except the brain admitted of a perfect examination.

"This examination of the body corroborates the facts in the previous report, and leaves no doubt in my mind, with some trivial exceptions, as to the accuracy of the facts stated in that report. I am of opinion that the death of J. K. was chiefly caused by exposure to cold during intoxication. I am also of opinion that the injuries described may have accelerated his death a little, but that they of themselves could not have produced it. The injuries on the head and neck were slight; they might have been caused by a fall or falls, and they did not indicate great violence. On the whole, I am of opinion that exposure to cold during intoxication, and external injury, may have, more or less, contributed in bringing about he fatal result in this case."—*(MS. Precognition.)*

Both of the first reporters concurred in this opinion; and two men, charged with murder, were soon thereafter liberated from prison.

This interesting case was much talked about in the district where it occurred, almost every person believing that the man had been murdered, and placed in the burn after his death.

It is surely not difficult to see how he may have found his way into the burn. That he had, during the course of his wanderings, suffered many falls, the injuries on his person sufficiently attest. There is nothing more probable than that, in his last fall, he stumbled into the burn, falling on his back; and that he had not strength sufficient to enable him to escape from this, as it was designated by one of the officials, his "water coffin." Or he may have been incapacitated by the sudden induction of the enormous cerebral congestion described in both reports. However this may have been, there is no reason whatever to make any one believe that the man was murdered. The external injuries were of a very trivial character, and could not have given rise to the great congestions in the three great cavities described in both reports. The numerous minute circular abrasions were nothing else than punctures, with a very slight loss of substance, made after death by a small bird, no doubt the water-ouzel *(sturnus cinclus)*, known to frequent all our burns. The condition of the larynx, trachea, and bronchi, mentioned in the second examination, forbids the idea of drowning.

Case 66.

J. H., examined on the 6th February, 1866. He was reported as 27 years of age, and as having been found dead in a ditch on the farm of Redmoss, near Lennoxton. The body in excellent condition, very muscular and robust, and nearly free from putrefaction. The countenance remarkably placid, the pupils dilated, an escape of bloody mucus, free from froth, from nostrils. No marks of external violence. The lungs were congested, and collapsed on exposure. The larynx, trachea, and bronchi free from frothy mucus and water. Heart enlarged by hypertrophy. Two white spots on it, one over the left ventricle, the other at the apex. Pericardium contained a good deal of serum. Both sides of heart contained fluid blood. Stomach healthy, and contained a good deal of solid ingredients of ordinary broth, but no water

or fluid of any kind. Brain very much congested, its vessels and sinuses being everywhere gorged with dark fluid blood.

This young man was liable to epileptic fits, and it was supposed that he had fallen into the ditch on his face when in a fit, and been thus suffocated or drowned. There is no evidence in the *post mortem* examination that he breathed in the ditch in water. The reporters were of opinion that his death was caused by apoplexy, having some relation to the diseased condition of the heart. This cardiac relation, also, was probably the cause of his fits.

Case 67.

T. G., reported as 32 years of age, and as having been found dead in Spout-head burn, near Lennoxton, on Monday the 23rd November, 1863. The body, examined on the 26th, was in excellent condition, very muscular, and quite free from putrefaction. The eyes were quite natural, and the tongue did not protrude. The fingers were firmly contracted. A little frothy mucus escaped from the mouth. There were no marks of external violence. The lungs adhered everywhere to the ribs by very old and firm adhesions; and in consequence of these adhesions they did not collapse on exposure. They were crepitant and quite free from congestion. The larynx, trachea, and bronchi were quite free from water and frothy mucus. The heart was twice its normal size, the enlargement depending on dilatation of all the cavities associated with fatty deposit on the right cavities and hypertrophy of the left. The tricuspid valve was incompetent. The right side of the heart and large vessels were distended with dark fluid blood. The stomach contained four ounces of a watery fluid free from odour. The liver was a good deal enlarged and very much congested. The bladder was empty. The brain and cerebellum were quite healthy and free from congestion.

This man had long laboured under symptoms of disease of the heart. In passing along a very narrow footpath without a parapet, he fell over a considerable precipice into the burn, where he was soon discovered. In the *post mortem* exami-

nation there are no indications of external violence, drowning, or of long exposure to cold; and the reporters were of opinion that the diseased condition of his heart was sufficient to account for his death and also for the sudden manner in which it took place.

Case 68.

A male child was found in the river Forth on the 2nd April, 1851, wrapped up in a piece of red merino curtain, and in which also was enclosed a large and heavy stone. The child had reached the full period of uterine life, and was symmetrically and well formed. Putrefaction had made considerable progress. Several inches of the cord, torn asunder and untied, were attached to the body of the child. There were no marks of external violence. The lungs were perfectly collapsed and quite free from crepitation. With the heart and thymus gland attached, they sunk in water of the temperature of 60°. Each of the lungs also sunk in water of the same temperature. Cut into thirty pieces, all of the pieces sunk to the bottom in the same water. The stomach contained only a very little mucus, and had evidently received no alimentary matter. Everywhere the body was free from congestion.—The reporters were of opinion that the child had been still-born.

Case 69.

The body of a female child was found in the river Forth, on the 27th August, 1866, and examined on the 28th. The child was very closely and tightly wrapped up in two pieces of cloth secured by a strong string, which had a free and large loop, as if it had held a large stone. The body was in good condition and free from putrefaction. The child measured nineteen and a-half inches in length, and the umbilicus was nearly in the centre of the length. Fourteen and a-half inches of the cord were attached to the child, and the cord had been unskilfully tied and cut. The pupils were very much dilated. The chest was very well expanded, and it sounded well on percussion. The child was symmetrical and well formed, but the bones of the head were very loose. There were no marks of external violence. The lungs were

of a florid red colour and crepitated freely. They rose, especially the left, over the sides of the heart. They weighed 804 grains, and floated buoyantly in water of the temperature of 60°. Cut into twenty-four pieces, all the pieces floated buoyantly in the same water, and even after being firmly compressed in a common towel, all the pieces still floated buoyantly. The right side of the heart and large vessels were very much distended with dark fluid blood, and both sides of the chest contained a good deal of bloody serum. The mouth, larynx, trachea, and bronchi were quite normal, and quite free from frothy mucus and water. The circulation was fœtal. The stomach contained a little mucus only, and had not received any alimentary matter. The intestines were filled with meconium. The gall-bladder contained bile: the urinary-bladder was empty. The brain and cerebellum were extremely congested with dark fluid blood.

The reporters were of opinion that the child was born alive, and that its death was caused by suffocation and not by drowning. The condition of the lungs, the entire absence of the signs of drowning, and the extreme development of the signs of apnœa, justify the opinion.

Case 70.

A female child was found in Mugdock Reservoir, the distributing basin of the Glasgow water-works, on the 21st May, 1869, and examined on the following day at Milngavie. The body is in good condition, and has evidently been carefully nourished and attended to. There is a binder round its chest, but all its other clothes have been removed. The condition of the pupils cannot be ascertained. Putrefaction has made considerable progress, especially on the head and face. On the head, the cuticle is peeling off, and the face is so much swollen and discoloured that the features cannot be distinguished. There is also some slight discoloration on the upper parts of the chest, both before and behind. There are no marks of external violence. The child weighs seven pounds twelve ounces, and its length is twenty-one inches and a half, the umbilicus being nearly in the centre of the length. The cord is detached, and the umbilicus is completely cicatrized. The tongue protrudes a little between the teeth.

The lungs are inflated, and, on exposure, collapsed without the application of pressure. They are quite crepitant, and quite free from capillary congestion. There is half-an-ounce of bloody serum in each side of the thorax. The larynx, trachea, and bronchi are quite free from water and frothy mucus. Both sides of the heart contain a considerable quantity of dark fluid blood. The pericardium contains two drachms of bloody serum. The large vessels, the venæ cavæ, the pulmonary artery, and the aorta, contain a considerable quantity of dark fluid blood. The stomach contains three drachms of a thick milk-like fluid, but no water. The intestines are filled with alimentary and feculent matter, showing that the child had been fully and carefully nourished. The urinary-bladder is empty. The large vessels and sinuses of the head are distended with very dark fluid blood.—The reporters are of opinion that the death of the child was caused by suffocation and not by drowning.

A woman, the mother of this child, was charged, at the Stirling autumn circuit of 1869, with the crime of murder, either by suffocating or drowning her child. She pled guilty to the crime of culpable homicide by drowning, and the plea was accepted by the Crown. It is evident, from the *post mortem* appearances, that the child had ceased to breathe before it was thrown into the water. There was no water in the lungs, no frothy mucus, no hyperæria. Some of the legal gentlemen connected with the trial thought that not only these signs, but also the sign of water in the stomach, might have been lost by putrefaction and by careless handling of the child. I cannot see this. The putrefaction was not great, and it was almost entirely confined to the head and face. The apnœal signs were quite recent and very strongly marked, and if hyperæria had ever existed, it would assuredly have been found at the inspection. The presence of the milk-like fluid in the stomach shows clearly that no water could have entered it and been afterwards lost by careless handling. True, the other two signs of frothy mucus and water in the lungs might have been lost by careless handling, but surely it would not

be safe to found a charge of drowning on the hypothetical assumption of a previous existence of these signs, afterwards so lost. No. I am quite satisfied that the child never breathed in the water, and that its death was caused by suffocation. If this, as pled by the prisoner, was a case of drowning, it was a case of drowning without any of the signs of drowning; a case hitherto unknown to the medical jurist, unless in the furthest advanced stages of putrefaction. It was brought out in the general evidence that the woman, in a state of distraction, had been carrying her child very closely wrapped up during a whole day.

I consider it unnecessary to offer any more cases illustrative of the diagnosis of drowning. The cases already given surely show that, in any case where the question of drowning could be raised, a diagnosis may be always readily found in the *post mortem* appearances; and if it is true, as no doubt it is, that many persons are drowned on the surface of deep water without being submerged, that many persons are drowned in shallow water accidentally and without criminal violence, and that many bodies, after violent deaths, are secreted in water, I hold I have established the position that these appearances, away from all other considerations, can alone lead to a certain diagnosis of any case. "There is no magnifying-glass like a prejudicate opinion." "Let us have God's truth in the measurements; God's truth in everything —I live for that."

APPENDICES.

APPENDIX A.

Since this essay was written, I have had an opportunity of examining a case of apnœa caused by the inhalation of a non-respirable gas. A. A., a man 60 years of age, always in the enjoyment of robust health, was, soon after eating a hearty breakfast, found in a state of insensibility in the "tank or cooler" of a secret work, on the 10th February, 1869. He died immediately after he was so found. I examined his body on the 12th, and the following is a copy of the notes of the case, taken during the inspection:—The body is in good condition, and quite free from putrefaction, the *rigor mortis* being still present. The pupils are quite natural. There are no marks of external violence. The lungs are quite healthy, collapsed, and free from congestion. The right cavities of the heart are very much distended with very dark and very fluid blood, and the aorta contains a good deal of blood, not very dark, but very thin and watery-looking. The mucous membrane of the larynx, trachea, and bronchi is very much congested, the congestion being greater in the trachea than in the larynx, and greater in the bronchi than in the trachea. The whole membrane is very red and swollen, especially in the trachea and bronchi, the redness and swelling increasing with the depth of the membrane in the chest. The mouth, tongue, pharynx, and œsophagus are quite normal. The stomach is quite healthy, and contains eight ounces of a thickish fluid resembling ordinary gruel. The intestines are healthy and empty. The kidneys are congested, and on each there is a vesicle, evidently distended with urine, the size of a large marble, remarkably symmetrical as to size, form, and situation. All the other abdominal organs are healthy. The

brain is very much congested. There are a great many bloody, and still bleeding, points in the centrum ovale, and the dura mater is also much congested, and studded all over with bleeding points.—The very remarkable appearance of the brain and its membranes, of the mucous membrane of the trachea and bronchi, and of the blood, left no doubt whatever that death had been caused by the inhalation of a noxious gas. It was afterwards admitted, that on the day stated the man might have been exposed to the action of sulphuretted hydrogen and also of carbonic acid gas.

APPENDIX B.

In forming an opinion as to the necessity of a medico-legal inspection in any case, it is always necessary to attend to its general circumstances. For example, I examined, in 1869, in the Western District of Perthshire, the body of a woman who died of cancer of the stomach. On opening the trachea, I was somewhat surprised to find three drachms of pure water in it, and on inquiry, I found that she had died suddenly while in the act of taking a drink of water, for which purpose her head and shoulders had been raised. This water, could its presence have been ascertained, might have led not only to an inspection on medico-legal grounds, but also, under other circumstances, to its being held as a sign of drowning. So with frothy mucus in the lungs, water in the stomach, and probably also with hyperæria.

APPENDIX C.

Pressure on the respiratory system of nerves and muscles, whether applied externally or internally, may produce fatal apnœa. In reference to external pressure as a cause of apnœa, Dr. Roget says, "Asphyxia is sometimes the result of pressure applied to the body in so general a manner as to impede not only the motion of the ribs, but also that of the diaphragm. This will happen, for example, to a miner, buried completely under a mass of earth that has fallen upon him. Death will,

in that case, be induced with greater rapidity than from most other causes of asphyxia, because the pressure will force out nearly the whole of the air contained in the chest, and preclude any further movement of dilatation or contraction of its sides. We shall," he continues, "mention only one remarkable instance, in which a person was in great danger of losing his life from inattention to the physiological conditions requisite for respiration. An athletic black, of pugilistic celebrity, had been selected, from the fine form of his chest and well marked expression of his muscles, as an academic model. It was wished to obtain a cast of his body; but this being attempted at one operation, and in one entire piece, as soon as the plaster began to set, he felt on a sudden deprived of the power of respiration, and, to add to his misfortunes, was cut off from the means of expressing his distress. His situation, however, was fortunately perceived just in time to save his life by breaking his bonds, and relieving him from the extreme peril in which they had placed him."—P. M. Roget, *Cyclopæd. Prac. Med.*, Art. *Asphyxia.*

APPENDIX D.

Cases of drowning on the surface of deep water, and without submergence of the body, occur constantly. Since this Essay was written I collected, during a very short time, the following well-marked cases:—

1. Mr. David Morgan, a Stirling merchant, was drowned at Portobello in July, 1869, without being submerged. After a long delay he was subjected, by two physicians, to Marshall Hall's method for restoring drowned persons.

2. Two days after the above event, a similar one occurred at Joppa. The following is taken from the *Scotsman* of 12th July:—"Between two and three o'clock yesterday, a man was observed to strip and go into the water close to Joppa rocks. After the lapse of about ten minutes, a party of gentlemen, who were sitting on the rocks at some distance, suspected that all was not right with the man, as they observed his *shoulders* rising up and down in the water, while his head was downwards. The gentlemen soon found that their fears

were confirmed. The man was in an insensible condition, in about nine feet of water. Every effort was made to restore the man, but all efforts failed."

3. On the 20th of the same month, the following report is found in the *Scotsman*:—"Both gentlemen swam towards Elliot, who by this time was in a very exhausted condition, and sinking. After struggling with the breakers for a while, Mr. Hind laid hold of Elliot by the hair of the head, and dragged the unfortunate gentleman, *who was then dead*, towards the shore. Dr. Huntly, of Jarrow, happened to be on the sands, and hastened to the scene, but all his skill to restore animation proved futile."

4. In the *Dundee Advertiser* of the 26th July we find the following statement:—"GALLANT RESCUE.—Boyce, sometime before Knight reached him, had exhibited no signs of action, and his *back* was the only part of him out of the water. As soon as Knight overtook him, he brought his head up, and so held it by the hair. Shortly after Knight left the shore, he was followed by a young man named J. Lindsay. Lindsay joined Knight, and each took an arm of the boy and with their freed arms struck out for the shore. When Boyce was lifted up on the beach there was no indication of life about him, but several of the bystanders applied themselves vigorously to his resuscitation, and in about *fifteen* minutes he gave evidence of reviving, and was then carried to a neighbouring cottage, from which he was able to proceed home about nine o'clock at night."

5. In the *Scotsman* of 11th August we have the following:—"BOY DROWNED AT EYEMOUTH.—On Monday afternoon, a fine boy, five years of age, fell into the harbour there, and was drowned. He had recently left his home, but was not observed to fall into the water, and the accident was not known till the body was seen *floating* on the surface, at a little distance from the place where he is supposed to have stumbled over the pier. The body was immediately taken out, and at once attended to by Dr. Forsyth, but all efforts to recover life proved fruitless."

6. In *Scotsman* of 19th October we read:—"KIRKCALDY. —MAN DROWNED.—Yesterday morning, about half-past five o'clock, the body of an old man was found *floating* in Kirk-

caldy dock. He was seen going about the harbour a little more than half-an-hour before his body was found."

7. In *Scotsman* of 13th November, 1869, we find:—"FALKIRK.—WOMAN FOUND DROWNED.—At an early hour yesterday morning, the dead body of a woman was discovered *floating* in the Forth and Clyde Canal, at Lock Six, near Bainsford, by the lock-keeper. The body, on being taken out of the water, was identified as that of Jean Marshall, the wife of a moulder named John Logan, residing in Grahamston. The deceased, it appears, had been drinking hard of late, and on Thursday (11th) night left her home, and nothing was heard of her till the recovery of her body in the Canal. She was about fifty years of age, and there is every reason to believe that she committed suicide by throwing her body into the Canal."

8. In *Scotsman* of 23rd May, 1870:—"LEITH.—MAN DROWNED.—Between two and three o'clock on Saturday morning, Mr. Slater, master of the steam-tug 'Blue Bonnet,' saw a body *floating* in the harbour near the Railway Bridge, and obtaining assistance, brought it to shore. It was subsequently identified as the body of Archibald Boag, labourer, apparently about forty-four years of age. Deceased was last seen, shortly after eleven o'clock on Friday night, near the place where his body was found, and at that time he was the worse of liquor."

9. "PORTOBELLO.—A BOY IN THE WATER.—Yesterday afternoon, while a number of children were amusing themselves by wading in the water, about full tide, a boy of four years of age was observed by the promenaders to disappear suddenly. When he came to the surface, he was *floating face downwards*, and but for the promptitude displayed by a gentleman, who rushed into the water and carried the boy ashore, he would inevitably have been drowned. The child was taken to Mr. Forsyth's, where he was stripped of his clothing, and received every attention. He rapidly recovered." —*Scotsman*, 14th July, 1870.

10. "DUNDEE.—BOY DROWNED.—The body of a boy, named William Robertson, six years of age, son of Mr. William

Robertson, residing in Princes Street, Dundee, was found *floating* in the Victoria Dock last night. The boy left home about four o'clock in the afternoon, and it is supposed that he had gone to fish, and while thus engaged had accidentally fallen into the water. The father of the unfortunate little fellow met the policeman carrying the body to the dead house, and identified his child."—*Scotsman*, July 19, 1870.

11. "LEITH.—BOY DROWNED.—Last night, between seven and eight o'clock, the body of a young boy was found *floating* in the harbour, near the Sandport Slip. When taken out, the body was warm, and appeared to have been a short time in the water. The boy was respectably dressed, and had on red stockings and elastic-sided boots. At a late hour last night the body was not identified."—*Scotsman*, July 22, 1870.

12. "GREENOCK.—BOY DROWNED.—While the steamer 'Bonny Doon' was sailing between Kirn pier and the new steamboat quay, Greenock, on Wednesday, a boy fell overboard, and disappeared before assistance could be rendered. The body was *washed ashore* at Kirn yesterday (Thursday) forenoon."—*Scotsman*, Friday, July 29, 1870.

13. "MELANCHOLY OCCURRENCE AT TYNEMOUTH.—Yesterday morning, a melancholy occurrence took place at the watering village of Tynemouth, near North Shields. It appears that Mr. Samuel Barras, a young man living in Park Road, Gateshead, had been staying at Tynemouth, and on Monday morning, between six and seven o'clock, he left his lodging and proceeded to the Long Sands for the purpose of having a bathe. After undressing himself in one of the bathing machines, he went into the sea, but he had not been in the water a few minutes before Mr. Nixon, bathing machine proprietor, observed him a short distance out *floating* on his back, and apparently lifeless. He at once proceeded toward him and brought him on shore. He was, however, found to be dead. It is supposed that he had taken a fit in the water." —*Evening Citizen*, Tuesday, August 9, 1870.

The whole of these, beyond all doubt, were cases of hyperæria occurring on the surface of deep water. The floating of the bodies demonstrates this. In no other way, that I know of, could they have been floated.

"On a fine summer day," says the *Lancet*, "some men are bathing in the sea. One of them, an excellent swimmer, suddenly cries out, 'I'm drowning,' sinks, and is no more seen until his dead body *floats ashore some hours afterwards.* This was the case with Mr. G. Waugh, whose lamentable death was noticed in the journals a few days since, and the dreadful incident was but a repetition of what occurs several times each bathing season. How is this terribly sudden drowning to be explained? The victim is generally said to have been attacked by cramp, and manuals advert to the subject, and direct the swimmer who is seized to thrust his leg out violently, and forcibly bend his foot upwards. The explanation seems to be generally accepted, but it does not really explain the awfully mysterious sinking. We do not need to ask a good swimmer whether cramp in the leg, however severe, would cause him to sink suddenly, and without a struggle, in the sea. It is impossible. The human body is specifically lighter than water, and so much lighter than sea water, that no effort is required to preserve it from sinking in that fluid. A swimmer seized with leg-cramp would instinctively throw his head as far back as it would go, conscious that he might remain afloat in this condition without the need of moving a muscle. The unfortunate swimmer who drowns under these circumstances goes down suddenly, and without a struggle. This signifies that the body suddenly becomes heavier than water. It can only do that by losing the air which is contained within the cavity of the chest, and the probability seems to be, that the cramp which happens is a cramp of the respiratory muscles, by which the expansion of the lungs is prevented, or their air forced out. Death then occurs as it often takes place in tetanus. This is a subject which has strangely escaped observation." (1869.)

The condition of the lungs here conjectured is the very opposite of hyperæria, and, if it exist, may be termed anæria. We have as yet, so far as I know, no pathological evidence of its existence. In no *post mortem* examination have I observed collapse of the lungs noted as a sign of drowning; and the *Lancet* speaks of the dead body *floating ashore some hours after the drowning.* This surely looks more like hyperæria than anæria. Bodies specifically heavier than water do not float ashore in a few hours after the drowning. It is only bodies specifically lighter that do so; and this lighter specific gravity of the body is alone derived from hyperæria, or from

putrefaction necessarily occurring long after the drowning. After all, I am inclined to the opinion that the cases on which the observations of the *Lancet* are founded were cases of hyperæria and not of anæria. "This," repeating the words of the *Lancet*, "is a subject which has strangely escaped observation."

The following, which I find in the *Reminiscences of Henry Crabb Robinson*, is worth quoting here. The floating of bodies ashore by hyperæria and by putrefaction is distinctly shown in the extract:—"William Pattison, the eldest son of my old friend, having been called to the bar, married the sister of a partner in Esdaile's bank, a Miss Thomas. Before the marriage, he informed me that his future wife wished that their marriage excursion should be to the Pyrenees, and he asked me for an itinerary. I lent him my journal. His intentions, however, were awfully frustrated. On arriving at the Lac de Gaube, they saw a broad boat lying by the shore; and the fisherman who usually rowed the boat had died a few nights before, and there was no one to take the oars. Pattison and his bride stepped in. They had no servant with them. He rowed into the middle of the lake. Then some spectators on the shore saw him standing up, and a shriek was heard, and he fell back into the water. His wife, rushing towards him, fell over also. About the middle of the day, an English barrister, a Mr. Alexander, coming down the mountain on the opposite side, saw something white on the water, and sent his guide to see what it was, while he was taking his luncheon. The guide came back saying that an English *mi lor* and *mi ladi* were drowned. Alexander went to the shore, and was there when Mrs. Pattison's body *floated* to the bank. He gave directions to have the body embalmed, and sent the fatal news to England. The distracted father spared neither trouble nor cost to obtain the other body, which, however, was not recovered till *several weeks* afterwards, when it *rose* to the surface."—*Diary, &c., of Henry Crabb Robinson, &c.*, vol. iii., p. 14. London, 1869.

APPENDIX E.

I drowned twenty animals in a solution of sulphate of iron, and tested their lungs and stomachs for the presence of water

in them with prussiate of potash. All of them showed that water, in the form of froth, had been inhaled even into the extreme bronchial tubes. Fifteen showed the presence of water in the stomach. In no case was the true balloon lung induced, for the lungs, although always preternaturally inflated, could be reduced completely by pressure. Frothy mucus was always present, but in less quantity in those animals that were not allowed to rise to the surface.

APPENDIX F.

I placed the bodies of twelve animals, recently dead, in a solution of the yellow prussiate of potash, having previously prepared them for the experiment by slitting their mouths as far back as the articulations of the jaws, and then keeping their mouths open by a bit of wood. The bodies were all then so placed in the solution as to keep their heads and mouths uppermost, and allowed to remain in it for four days. In no case did the stomach show any reaction with the Tinctura Ferri Perchloridi.

APPENDIX G.

The treatment of drowning is a very difficult and obscure subject, and more especially as regards the employment of artificial respiration. If the doctrine of hyperæria taught in this Essay is true, artificial respiration in extreme hyperæria must necessarily prove highly injurious, by forcing air mechanically into lungs incapable of acting, and already over distended. It does not follow, however, from this that artificial respiration must be hurtful in all cases of drowning. On the other hand, there is reason to believe that in many cases of drowning, and probably in the great majority of cases, it may, when skilfully used, prove very beneficial, even although some hyperæria may be present. In the case of the child, for example, which I have just narrated, it might, I believe, have been employed with some advantage, for in it the hyperæria was not fully developed. There certainly was no extreme

distension of the air-passages, and nothing to forbid the cautious injection of a little air or oxygen into them. It is only in cases of extreme hyperæria that artificial respiration can become dangerous, and ought to be avoided. When, then, the chest is preternaturally resonant on percussion, when the ribs are raised to the acme of inspiration, and when the neck is full and swollen at its lower part, immediately above the clavicles, the use of artificial respiration is contraindicated, and ought to be withheld. In the present state of our knowledge, there is, I believe, no remedy whatever for extreme hyperæria, the most fatal and irremediable form of drowning. The methods of Drs. Hall and Sylvester are entirely out of the question in such a case; and here something more heroic and efficient than these methods, so generally confided in, is surely needed. It has occurred to me, after reading the accounts of the safe and successful use of saline injections into the veins in cholera, that something of this kind might be tried in hyperæria, and, indeed, in all apparently hopeless cases of drowning. The cases of cholera and hyperæria, perhaps, are not exactly parallel; but there is a similarity in them sufficient to warrant a trial of a remedy in a case beyond all other hope. Should this suggestion be approved of, some highly oxidising substance, such as the peroxide of hydrogen, might be tried. How would this affect the dark fluid blood accumulated in the right cavities of the heart and large vessels? How the heart's irritability? How the respiratory system? It is satisfactory to find, from two cases mentioned in Appendix D, cases 4 and 9, that an amount of hyperæria sufficient to float the body may be recovered from, even under rude, and necessarily unskilful, treatment. Should the injection into the veins be tried, it will be necessary to guard against any injury that might arise from the artificial plethora thus induced, by free blood-letting, &c. [1]

[1] I have just seen, in the April number of the *British and Foreign Medico-Chirurgical Review*, an original communication on the pathology of cholera and apnœa, by Dr. George Johnson, in which he says, "The *post mortem* condition of the lungs and of the heart's cavities, is precisely the same in acute apnœa and in cholera collapse." Again he says, "I have also shown that blood thickening is common to cases of apnœa and cholera collapse." This, surely, is very encouraging. In opposition to some views of Dr. Murchison's, he says, "I still believe that the warmth of the injection has a powerful influence in diminishing arterial resistance, and for these reasons: men who have had much larger experience of saline injections in cholera, declare that hot injections are more efficacious than tepid fluids. Dr. Mackintosh, in the year 1832, injected 156 patients, of whom 25 recovered. The

APPENDIX H.

Some persons may think the opinion of the cause of death too strongly stated in this case, and perhaps it is so. The apnœal signs and frothy mucus in the air-passages do not, under all circumstances, establish the fact of drowning; and it is only in cases where the question of drowning could be raised that a diagnosis of drowning would be justified. Perhaps in all cases similar to the one just detailed, it would be better to report the cause of death simply as apnœa, without specifying the cause of the apnœa. In the following case, for example, had the suffocating medium been water instead of blood, a diagnosis of drowning, following out the argument in the text, might have been found. In this case two pools, one of blood and the other of water, were found on the floor of her own house; but the woman's face being immersed in the blood and not in the water, the diagnosis was death from suffocation; whereas, had her face been immersed in the water and not in the blood, the diagnosis, adhering to the text, would have been death by drowning.

M. R. F., reported as 66 years of age, as a drunkard and an opium-eater, and as having been found dead on the floor of her own house on 5th December, 1869. It was also reported that there were two pools, one of blood and the other of water, on the floor, and that the face of deceased, when found, was immersed in the pool of blood, which had issued from a wound in the nose, made by one of many fragments of a wash-hand basin found on the floor. This fragment was found deep in the wound on the nose.

temperature of his injections varied from 106° to 120° F., and he states that the good effects of the injection were rapid in proportion to the heat of the solution. Mr. Little injected 20 cases at the London Hospital, in 1866, of whom 5 recovered. Mr. Little's injections had a temperature of 110°, and he states that a temperature below 100° is decidedly injurious." Dr. Johnson, in support of his own theory of cholera, further says, "I have never denied or doubted that the mere addition of liquid to the blood may be of use, by supplying the vehicle for removing the poison and its products from the system, *but this does not explain the almost instantaneous benefit resulting from the hot saline injections into the veins.*"—On Some Points in the Pathology of Cholera and Apnœa, by George Johnson, M.D., &c., &c. *Medico-Chirurgical Review*, April, 1870.

Should this mode of treating the apnœa of drowning be tried, the solution, whatever its nature, must be hot, certainly not under 110°.

The body is very obese, and the feet and legs are very œdematous. The body, notwithstanding, is in good condition, and quite free from putrefaction, the *rigor mortis* being still present. The pupils are quite normal. The lips are livid. There is an incised wound on the left side of the nose, an inch and a-half in length, detaching completely the cartilage, and exposing the cavity. There is also a slight contused wound recently made on the upper part of the forehead, having some dried blood about it.

The lungs are very much congested, and the air-passages are filled to overflowing with a very thick frothy mucus. The heart is normal. Its right cavities and large vessels are very much distended with very dark fluid blood.

The stomach is healthy and quite empty. The liver is bloodless, very soft, and easily torn by the finger.

The brain and cerebellum are very much congested, and all the sinuses are gorged with very dark fluid blood. The ventricles are filled with serum.

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